

# To Study The Perception Of Female Employees Of The Hotels About The Facilities Provided To Them And Its Impact On Their Satisfaction

Paper ID	IJIFR/V3/ E11/ 006	Page No.	3970-3980	Subject Area	Hotel Management
KeyWords	Hotel, Female Employees, Perception, Facilities, Top Management				

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## Abstract

The hotel Industry has been given the status of the Industry way back in 1986. It is expected that being "the industry" the Human Resource norms for hotel employees should be same or at par with those applicable for the employees of the Industry. With the Increasing number of female employment in the Hospitality sector there is a need to understand whether hotels should rethink on the norms and facilities provided to these employees. The research paper aims at identifying the facilities provided by the management to their female employees and to understand the perception of female employees whether these facilities are actually provided or are just on paper and also to gauge the impact of these facilities on their satisfaction. This paper highlights the perception of female employees about the facilities provided to them by the management. At the same time the paper also takes into consideration the perception of the management whether any special facilities are provided to their female staff. The study employed a descriptive research design. The sample size was 52 respondents from different five star hotels in Pune. A purposive random technique was used to select only female employees who are working in hotels and the representatives of the top Management. Questionnaires and interviews were used to collect primary data while secondary data was referred from research articles. Through the observation and discussion it has been reflected that women employees do



agree about a few facilities available to them, whereas have a difference of opinion about availability of a few other facility from that of management. This suggests that sometime facilities are proposed by the management but actually it may not be available for the women employees or also indicates that women employees have not availed the facilities and hence are not aware of its existence which results in the perception gap.

## 1. INTRODUCTION

Hotel industry is growing leaps and bound. Like any corporate industry hotels also depends upon their manpower to a great extend to not only serve the guests but for all the operations. This manpower comprises of male and female employees. With the growing number of women joining the hotel industry, there definitely is a need to lay emphasis on the professional needs of the female employees which would surely be different from that of male employees of the hotel. This research paper tries to find out if the management of the hotel have designed any policies especially for women employees of the hotel, if so are the women workers well aware of these policies. Further to that the paper also tries to find out if women employees are satisfied with these policies offered by the management or is it something beyond this that they need. Because there may be a perception gap between what actually the employee needs and what is offered by the management. To any industry employee facilities as medical, leaves, subsidized food, transport are the common perks offered by the management but for a women working in hotels have to work for long hours as compared to any other industry and hence may need additional facilities as pick up drop during odd hours, or special leaves as maternity, or even crèche facility for the young child and flexible working hours.

## 2. LITERATURE REVIEW

- I. **Megha Gupta (2015)** Gender equality policy in Indian hotels reveals that most of the hotels are not adopting the proactive policies for the representation and empowerment of women employees. The representation is more visible at the entry or the supervisory level whereas it's very lean at the top positions. There is a need to revive the HR policies to encourage more or equal representation of women at higher positions too.
- II. **Anumeha Chaturvedi & Varuni Khosla (2015)** As per the article published in The Economic Times The Grand Hyatt in Mumbai became the beneficiaries of a tweak in the leave policy they introduced for their 1,000 associates or employees five-day weeks or eight days off a month as a part of a Hyatt Hotels initiative to offer a friendlier regime on holidays.
  - The initiatives range from more generous leave policies to complimentary room nights for staff.
  - Taking good care of employees who help them serve customers better, hotel chains believe.
  - The Grand Hyatt in Mumbai also hosts a staff recreation area and has relaxed grooming guidelines for women employees. It has also empowered service associates

to take quick decisions without requiring a manager's approval to improve the guest experience.

- Starwood Hotels & Resorts is thinking of providing more part time options for women.
- Accor encourages new entrants to spend the first night at the hotel with their families to get to know the brand and gain a customer experience at first hand.
- It has also introduced awards to recognize employee performance across its India properties and put in place round-the-clock staff grievance hotlines over the past year.
- Marriott India's employees have a 40-hour work week and hour long lunch breaks. It's a six-day week but managers are asked to make sure staff doesn't exceed shift timings.
- Employees are also offered 50% off on food and beverage and for their weddings.

The impact of these new policies is that the associates can utilize the additional time to explore their hobbies and personal interests. This, in turn, results in their associates being better rested and rejuvenated and Ultimately, the guests' interactions also have improved as the associates exhibit higher levels of empathy based engagement . It gives equality to employees in comparison with other industries and it is a positive step.

**III. Your story Media Pvt Limited (2012)** Ajuba Solutions, a provider of revenue cycle outsourcing services to healthcare systems in the US with over 1900 employees currently who have **47 % of their workforce comprising of women**, which is one of the highest in the industry, and hence they have designed special policies for the women employees and provides a women-friendly environment .They have designed Top 5 HR Policies that worked for their women-force:

- **Women's Forum Shakti:** to connect all women employees and encourages them to come up with problems that they face at work and suggest ideas to improve the work environment.
- **Gynaecologist on Call:** Engaging a Gynaecologist especially for women employees at the health center
- **Women's Lounge:** A special lounge has been created that offers a space to pregnant or unwell women employees for resting and relaxing.
- **Flexi work hours:** **Programs focused on women** to contribute to their holistic development. These include self-defence program and breast and cervical cancer awareness programs

**IV. Women's Rights And Labour Statutes (Shodganga2014)**

The article says that women belong to the weaker Section of the society. They need equal treatment and special protection under the law. This special treatment to women workers is due to the peculiar and psychological reasons, such as their physical build up, poor health due to repeated pregnancies, home drudgery and due to nature of occupation in which they are engaged. To protect this vulnerable group, many legislative provisions have been provided in almost all labour statutes which address problems of women labourers in their employment situation.These labour welfare legislations are of two kinds. The first category contains those statutory enactments which are exclusively for women workers, e.g. the Maternity Benefit Act, 1961 and the Equal Remuneration Act,

1976. In the second category are included those labour statutes which provide measures for the workers at large but contain special provisions for the welfare of women workers. These legislations relate to regulation of employment in dangerous occupations/employments, prohibition of night work, restriction on carriage of heavy loads, wages, health, gratuity, maternity relief, equal pay for equal work, social security, provision of crèches and other welfare facilities etc. Special provisions relating to women in factory Act

**V. L.V. Subramanian (2016):** In the article in [Indianlabour.org](http://Indianlabour.org) various acts are provided for women employees as the Maternity Benefit Act, The Equal Remuneration Act was passed in 1976, providing for the payment of equal remuneration to men and women workers for same or similar nature of work. The enforcement of the provisions of this law is regularly monitored by the Central Ministry of Labour and the Central Advisory Committee.. Implementation of guidelines regarding sexual harassment has already begun by employers by amending the rules under the Industrial Employment (Standing Orders) Act, 1946. Guidelines to prevent sexual harassment of working women are also provided which specifies that it's the duty of the employer to prevent or deter the commission of any act of sexual harassment at the work place. Sexual harassment will include such unwelcome sexually determined behavior by any person either individually or in association with other persons or by any person in authority whether directly or by implication.

**VI. Manjula Chaudhary and Megha Gupta (2010)** the study aims at women's position in the hospitality or other industry. In Indian industry woman hold more positions of power now than in the past. Indian hospitality industry also shows the same pattern. But compared to their share in population women hold few positions compared to males. This is in spite of a various measures taken by the government through legislation and policy measures.. A study of Perception of male and female employees aims to examine whether female employees of hotel industry perceive gender equality issues differently than male employees. The issue discussed among employees of the hotels "women do not get same fringe benefits as men". But the result indicates that both men and women employees have similar view point about the gender issue.

### 3. OBJECTIVES OF THE STUDY:

- i.) To study the nature and kind of facilities given by the management to their female employees.
- ii.) To understand the employees perception about availability of these facilities to them.
- iii.) To study the impact of these facilities on satisfaction level of the female employees.

### 4. RESEARCH METHODOLOGY

Collection of data: The data required was collected using the following techniques:

- Personal interviews:

The researcher conducted personal interviews with the management and female employees of the various five star hotels to understand the special facilities provided for the female employees

- **Questionnaire:**

A questionnaire was made and circulated to the management representatives and female employees of the hotels to obtain their views.

- **Selection of sample:**

The study has been conducted to identify the perceptions of the management about the special facilities provided to female employees in the hotel industry in Pune. A sample of the management representative and female employees has been selected at random from different five star hotels in Pune city.

## 5. DATA ANALYSIS

### I. Perception of Managers about the facilities provided to female employees

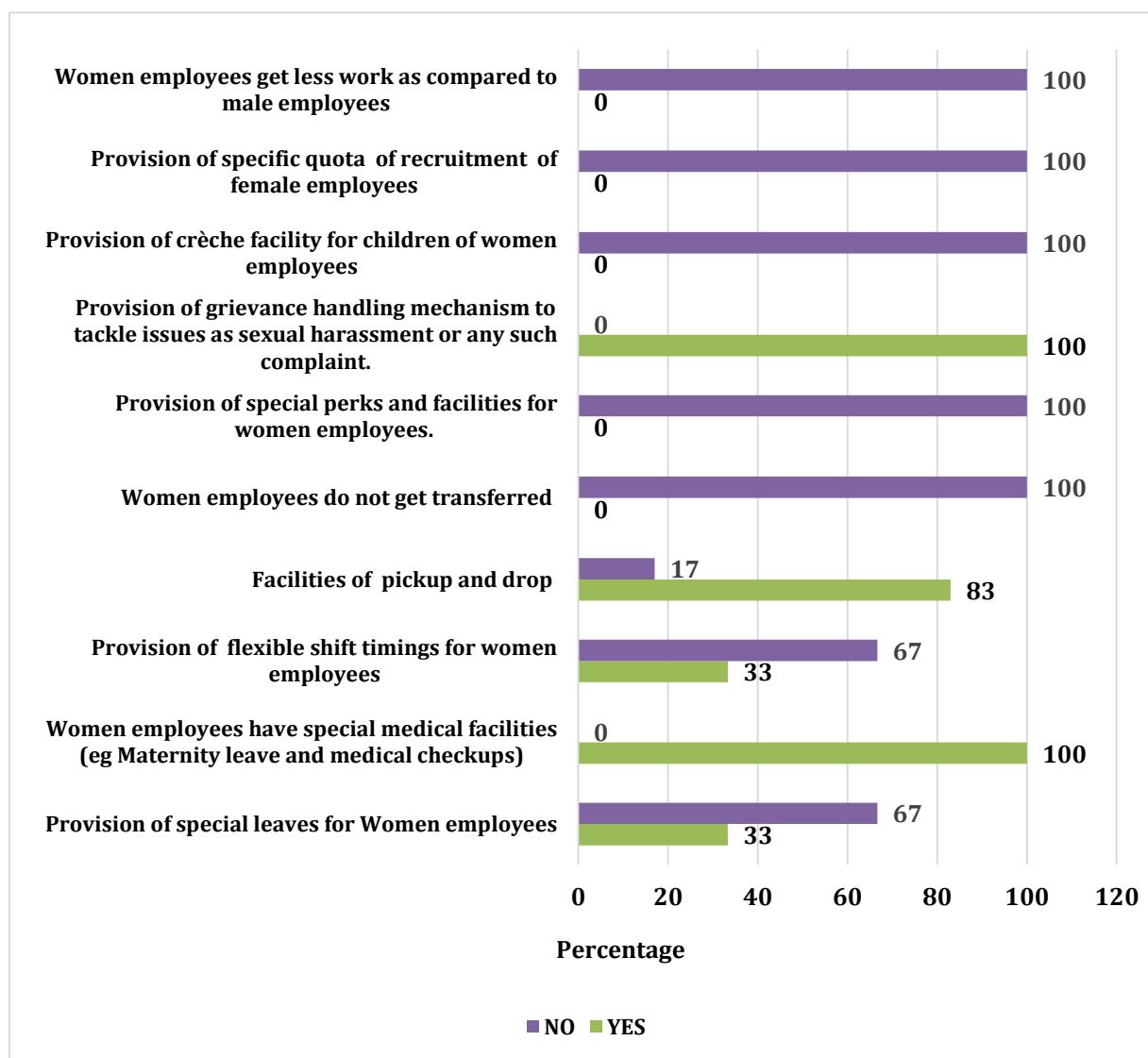


Chart 1: Perception of managers about the facilities provided to female employees

The research reveals that management do offer several facilities for their women employees of which some are same as what is offered to the male employees of the organization .There is mixed reaction about provision of special leaves is concerned. But every management do provide maternity leaves for their female employees. Provision of flexible times for female employees is available only in 33% of hotels. None of the hotels have provision for special perks for the female staff and no rule that they will not get transferred. On a very positive note it's nice to know that hotels have grievance handling mechanism which is essential for the safety and security of the female employees.

But on the other hand there was no provision of Crèche which is actual an essential provision in factories Act 1948, Female employees get the same work as their male counterparts irrespective of the physical constraint. There is no discrimination in assigning work amongst employees on the basis of their gender.

The hotels do not have set quota for recruiting female employees. But there are certain jobs in the hotel for which female employees are preferred. Female employees are given the same workload as their male counterparts. Gender is not considered while assigning responsibility and work.

## II. Perception Of Female Employees About The Facilities Provided To Them

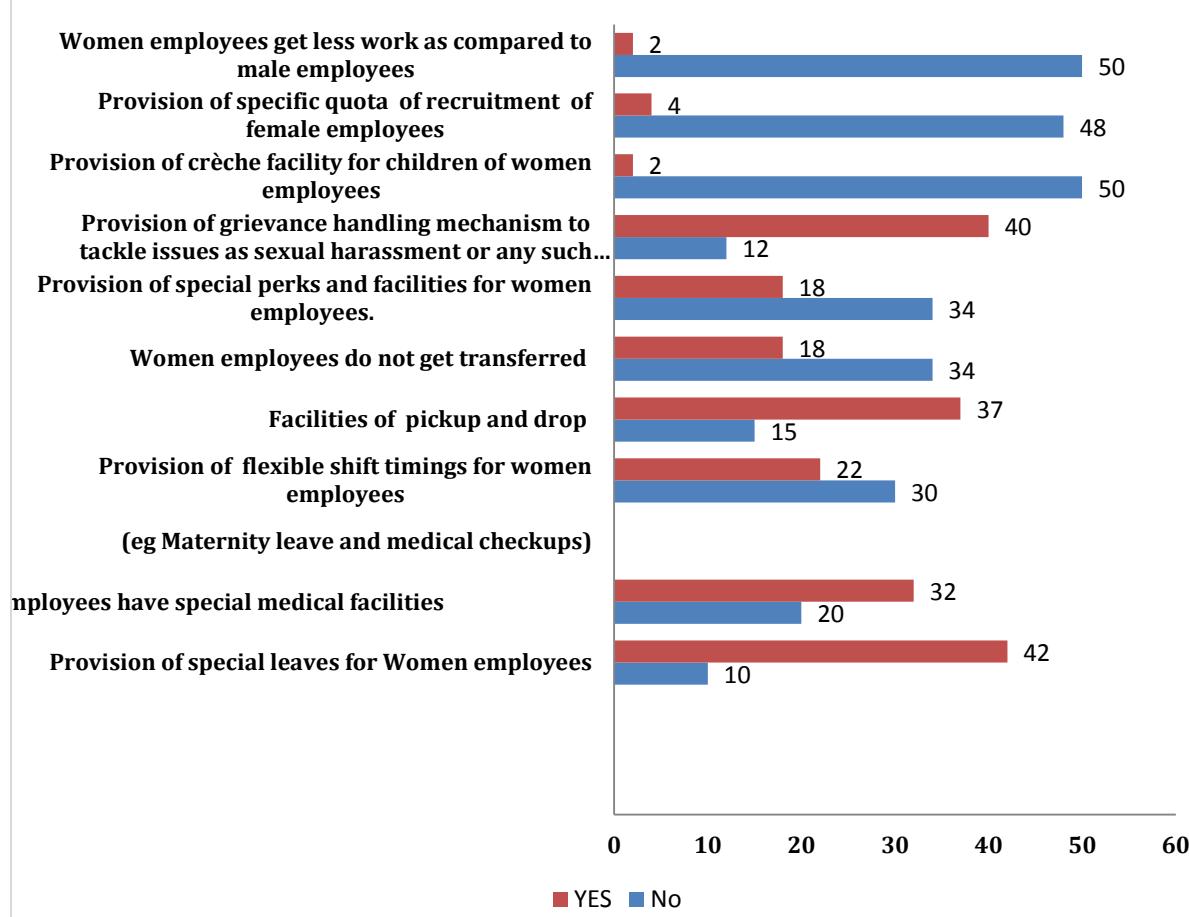


Chart 2: Response of Female employees about the facilities provided to them

The paper tries to compare the responses of the management and female employees for the same set of questions asked to them. The women employees do not have special leaves as per 92% of female employees. 71% of women agrees that there is a provision of maternity leave which does not matches with the management responses which indicates that 100 % managers agree that provision of maternity leave is available for female employees. The perception doesn't match about the pickup and drop facility, and flexible shift timings as well .Whereas the perception about crèche facility, special perks for women employees, provision of specific quota for employees precisely matches with the management perception .. There is a mixed opinion about women getting transferred. As far as grievance handling mechanism is concerned there again is a difference of opinion as 100% managers agrees that grievance handling mechanism exists whereas only 77% of women agrees that it exists. This could be due to perception difference or probably some of the women employees are either not aware or not availed of the said facility.

### III. Comparison Of Perception Of Female Employees And Management About The Facilities Provided To Them.

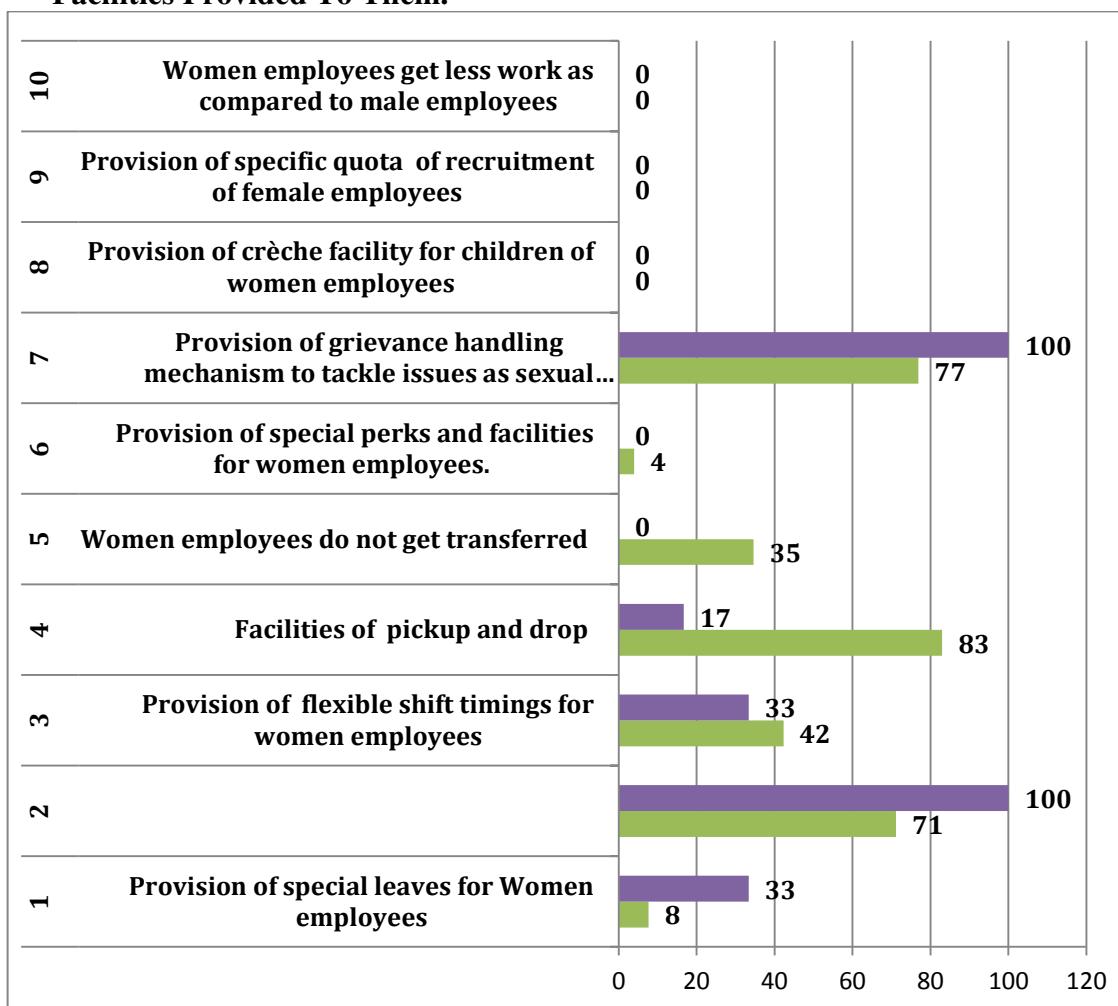
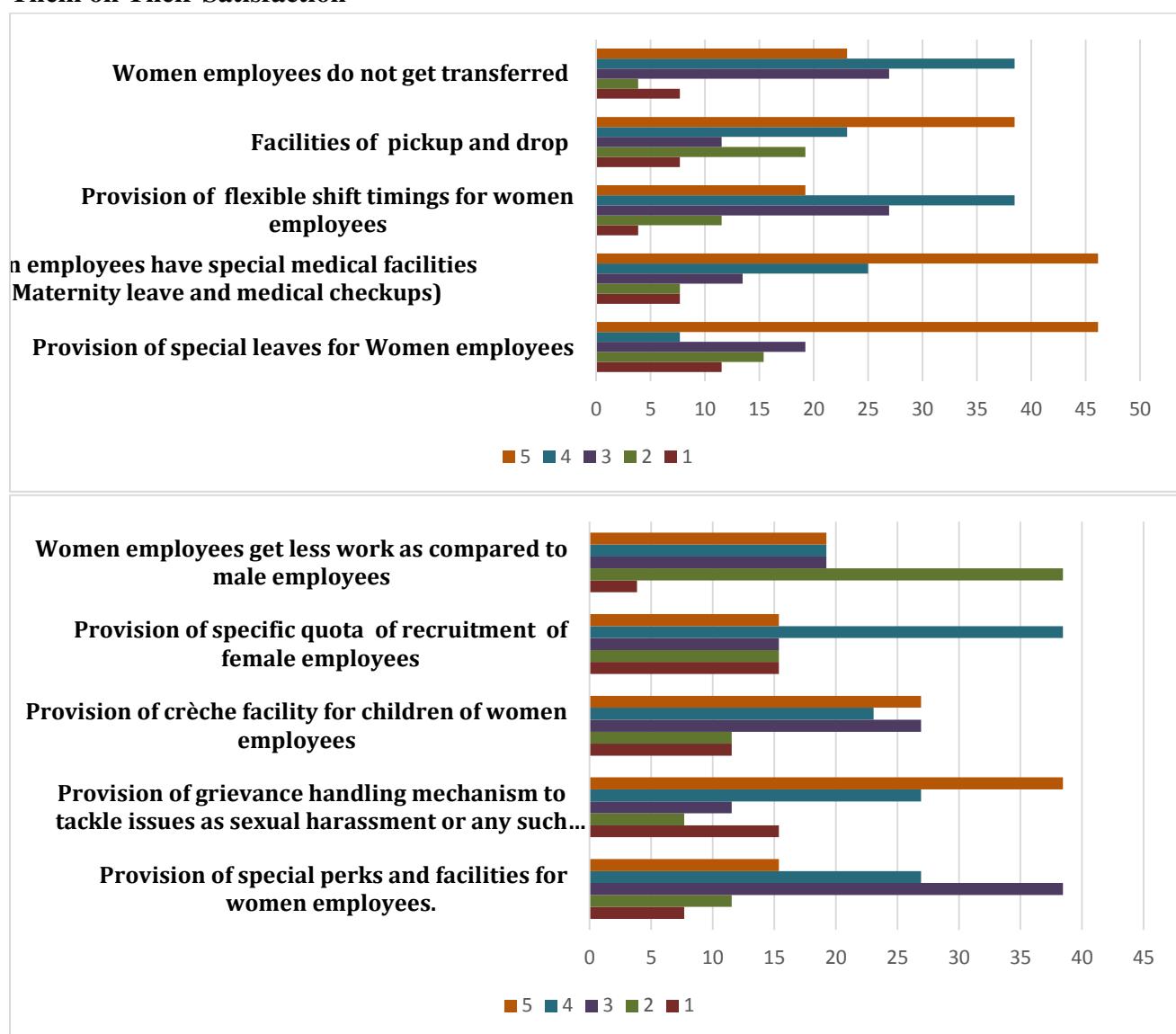


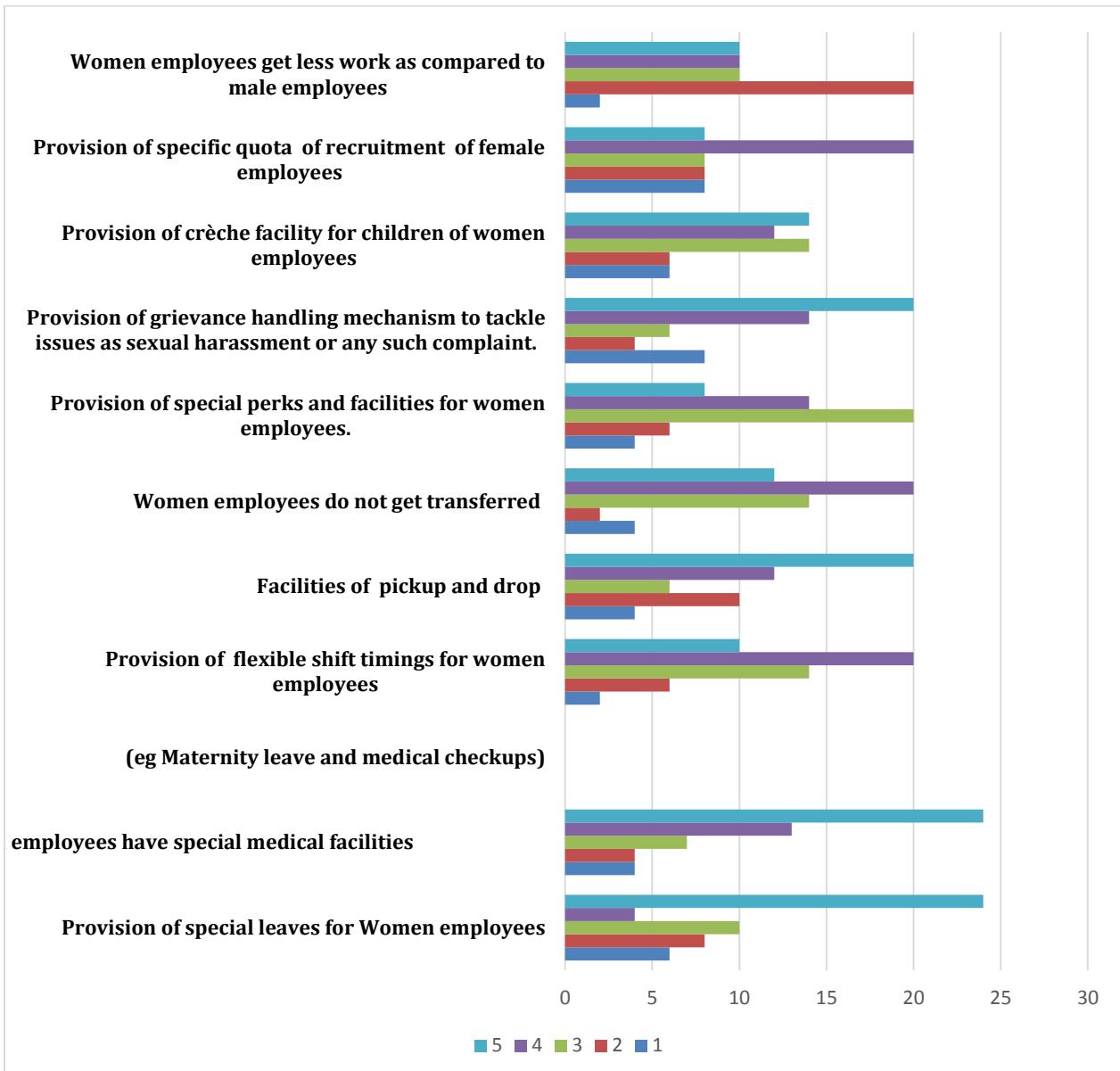
Chart 3: Comparison Of Perception Of Female Employees And Management About The Facilities Provided To Them

The research indicates that the perception of female employees do differ from that of management as far as facilities like **Facilities of pickup and drop and Women employees do not get transferred**. Employees agree that these facilities are available whereas management does not provide these facilities. According to them the pickup drop is available only during odd hours and late shift and special occasions. Parameters of Women employees have special medical facilities (eg Maternity leave and medical checkups) and Provision of grievance handling mechanism have are available to women employees as per 100% managers whereas only 71-77 % employees agree that this is available to them.

#### IV. Perception of Female Employees about the Impact of the Facilities Provided To Them on Their Satisfaction



**Chart 4: Perception of Female Employees about the Impact of the Facilities Provided To Them on Their Satisfaction**



**Chart 5: Perception of Female Employees about the Impact of the Facilities Provided To Them on Their Satisfaction**

Each facility provided to an employee has either a direct or indirect impact on them. Presence of some facilities such as transport, perks etc. are considered essential whereas special facilities such as crèche, family care, health care are seldom offered by the employer but may have a great positive impact on the employees. The paper tries to find out the impact of each facility given to female employees on their satisfaction. Special leaves provided for women employees especially Maternity or similar leaves has greatest impact on them has been rated as most important facility. Which means women need special leaves not only during pregnancy or maternity period but it also helps them to ease out their work life balance. Second facility which has phenomenal impact on women employee is Grievance handling mechanism prevailing in hotels. This ensures that female employees are more concerned with their safety and “being heard” for any issues cropping

up at the work place. The provision of pick up and drop facility and women employees not getting transferred is also observed to have a moderate impact on women employees. Surprisingly availability of crèche facility which should have been one of the important facility doesn't have a great impact. The facility which may be considered as the least important is women getting lesser work than male employee. This indicates that women are ready to carry out all the responsibilities which may be done by the male employee.

## 6. FINDINGS

Overall the outcome of the paper suggests that

- I. Management of the hotel offers numerous facilities to their employees but there are very few facilities especially for women employees.
- II. There is a discrepancy about availability of certain facilities such as provision of special leaves other than maternity or grievance mechanism, where management says it exists and all the employees do not agree for the same.
- III. Availability of facilities as provision of special leaves (Maternity) and Grievance mechanism has the greatest impact on women employees whereas facilities like Women employees get less work as compared to male employees does not have significant impact on women .
- IV. All managers confirm that there are no special perks and benefits to female employees

## 7. CONCLUSION

The research was based on the surveys and interviews carried out with the female employees and Management representatives. In order to understand if there is any provision of special facilities for women employees in hotels .If there are, then are the employees well versed with it and avail them. Or are these facilities merely on paper. The paper tries to find out the impact of these facilities on women employees satisfaction level. It has been observed that management do provide some special facilities as Medical/ Maternity leaves and are agreed upon by the employees .The study also indicates that the management do not consider gender while assigning work to female employees or if they need to be transferred. There is a discrepancy noticed in management's say and women employee's perception about the provision of special leaves and grievance handling procedure. As far as the most desired or important facility which female workers would like is Maternity/ special leave followed by Grievance mechanism. It suggests that safety and security is the prominent factor for employees where as they are not much concerned about the work assigned to them and this factor has the least impact on them.

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ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

**Volume - 3, Issue -11, July 2016**

**Continuous 35<sup>th</sup> Edition, Page No.: 3970-3980**

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**Dr. Seema Zagade, Anuradha Karmarkar:: To Study The Perception Of Female Employees Of The Hotels About The Facilities Provided To Them And Its Impact On Their Satisfaction**

**3980**

# A Study On Attitudes Of High School Students Towards Learning Of History Subject In Hasan District Of Karnataka

Paper ID	IJIFR/V3/ E11/ 007	Page No.	3981-3988	Subject Area	Education
KeyWords	Attitudes, History, Secondary School Students, Learning				

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## Abstract

The purpose of this study was to investigate students' attitudes towards learning History. The samples from Hassan districts of Karnataka randomly selected. The students' questionnaire prepared by author himself. The students' questionnaire used a 5 point-Likert scale ranging from strongly agrees to strongly disagree. The data collected was analyzed by use of descriptive statistics and presented with the aid of tables, percentage and graphs. From the analyzed data major discussions were made and reported. Most of the students were found to be having positive attitude towards learning History.

## 1. INTRODUCTION

History is a means to understand the past and present. The different interpretations of the past allow us to see the present differently and therefore imagine and work towards different futures. Through the study of history we can investigate and interpret why society developed as it has and determine what influences have affected the past and present and shape the future. It helps one to understand the immense complexity of our world and provides insights to help cope with the problems and possibilities of the present



and future. History also provides a sense of identity to understand the collective past that has made us what we are today. In one sense history is the only thing that is real. The way in which people identify and interact with one another is by and large a consequence of history, which shapes and conditions individuals and societies whether they fully understand it or not.

## 2. NEED OF THE LEARNING HISTORY

- i.) **History helps us understand the world:** History enables us to understand how the world worked then and how it works now. History provides us with the framework of knowledge that we need to build our entire lives. It takes us closer to happenings and events in the past we can know about and learn how things have changed ever since, and who were the figures and personalities that helped change the scenario.
- ii.) **History tells us who we are:** History is a story of the past happenings, events and transformations. It is a depiction of what happened in the years since the inception of human race. Therefore study history to understand the origin of our existence. It helps us understand who we are? Where our ancestors came from? What was the society and culture that they lived in? What is that we have inherited from them? What is it that we have to do to be like them? It helps us understand everything about our past.
- iii.) **History helps understand cultures:** History is a deep rooted knowledge and study of the past. Given its vastness and the diversity that it covers, we can know almost everything that happened in the past and the then demography of any part of the world. We can learn the types of cultures and traditions people followed as well as their way of living. All cultures that we know of today have their roots in the cultures of the past.
- iv.) **History helps us judge wisely:** History serves as a laboratory that helps us experiment with the past. The past serves as evidence in our quest to know why people behave in a particular manner. Therefore, decision makers have to resort to history to make factual judgments based on the happenings of events and related facts. By understanding the past behavior, one can analyze the present behavior without bias.
- v.) **History helps understand change:** With a deep rooted study of history one can know best how people, communities, nations and the world that we live in has changed over time. Each person's view of the world is shaped by his/her individual experiences and the experience of the group he lives in. If a person isn't aware of the historical experiences of cultures and nations, he cannot fully understand need of changes and development that sweep a society every now and then.
- vi.) **History helps us become good citizens:** History helps us imbibe and develop essential skills required to become good citizens of the nation and the world as a whole. Informed and well versed citizens, who know their roots, cultures and cultural diversities, understand the need for a wise and fair development of their society. A democracy, or any other form of governance, is reformist only when it is filled with informed citizens.
- vii.) **History helps us learn of world events:** Our world has borne witness to countless incidents of importance or otherwise. If one has to know of any of these happenings or

events that changed the world, he/she has to dive to the depths of history books to know why a certain event happened. There is no better way to know the world like the back of your palm than to study history.

- viii.) **History is interesting:** There may be different takes to this point but the truth is that history is very interesting. History for some can be monotonous but for others it is like watching a blockbuster film entirely based on true events. History is full of real drama, action and emotions; it is a chronicle of life. Those who enjoy life will also enjoy knowing about someone who conquered the world or someone who died for love.
- ix.) **History makes you a better student:** History is the study of the past but it is capable of shaping the present. History helps students know where we come from, how the past has shaped us, and how we can shape the future. History makes students all-round individuals who accumulate a balanced understanding of both the past and present. Because we ourselves make history every day, the study of it helps us in knowing what our forefathers did in the past and whether or not it was right.
- x.) **History repeats itself:** I have detailed nine of the best reasons to study history, but by far the most important and the biggest reason to study history is because history repeats itself. It is important to read and learn about others mistakes in the past so that we do not commit the same mistakes in the future. It is very important to not repeat the kind of things that have not really helped the world in anyway but have only added to the miseries of mankind. It is believed that those who cannot learn from history are doomed to repeat it. This paper studies the attitude of Secondary school students of Hassan district of Karnataka towards learning of history subject.

### 3. STATEMENT OF THE PROBLEM

The problem of the present study is specially stated as: “A Study on Attitudes of High School Students towards Learning of History Subject in Hasan District of Karnataka”

### 4. OBJECTIVES OF THE STUDY:

- i.) To analyze the attitude of Secondary school students of Hassan district of Karnataka towards learning of history subject.
- ii.) To compare the attitude of male and female Secondary school students of Hassan district of Karnataka towards learning of history subject.
- iii.) To compare the attitude of urban and rural Secondary school students of Hassan district of Karnataka towards learning of history subject.
- iv.) To compare the attitude of Govt. Aided and private Secondary school students of Hassan district of Karnataka towards learning of history subject.
- v.) To compare the attitude of Kannada and English medium Secondary school students of Hassan district of Karnataka towards learning of history subject.
- vi.) To compare the attitude of different taluka's Secondary school students of Hassan district of Karnataka towards learning of history subject.

## 5. HYPOTHESIS

- 1st.  $H_01$ : There is no significant difference between the attitude of male and female Secondary school students towards learning of history subject.
- 2nd.  $H_02$ : There is no significant difference between the attitude of urban and rural Secondary school students towards learning of history subject.
- 3rd.  $H_03$ : There is no significant difference between the attitude of Govt., Aided and private Secondary school students towards learning of history subject.
- 4th.  $H_04$ : There is no significant difference between the attitude of Kannada and English medium Secondary school students towards learning of history subject.
- 5th.  $H_05$ : To compare the attitude of different taluka's Secondary school students of Hassan district of Karnataka towards learning of history subject.

## 6. DESIGN OF THE STUDY

### 6.1. Population of the study

500 Secondary school students of Hassan district of Karnataka comprised the population of this study.

### 6.2. The Sample and Sampling Procedure

500 Secondary school students of Hassan district of Karnataka were taken as representative sample of the whole population. Among those 250 male and 250 female students, 250 urban and 250 rural students, 167 govt., 167 private and 166 aided school students were selected randomly.

### 6.3. The Tool Used

An attitude scale (Likert Type) was used for knowing the attitude of Secondary school students of Hassan district of Karnataka towards learning of history subject. The tool was prepared by researcher himself.

## 7. ANALYSIS OF DATA

Both "t" and "F"- test were used to analyse the collected data and verify the hypotheses.

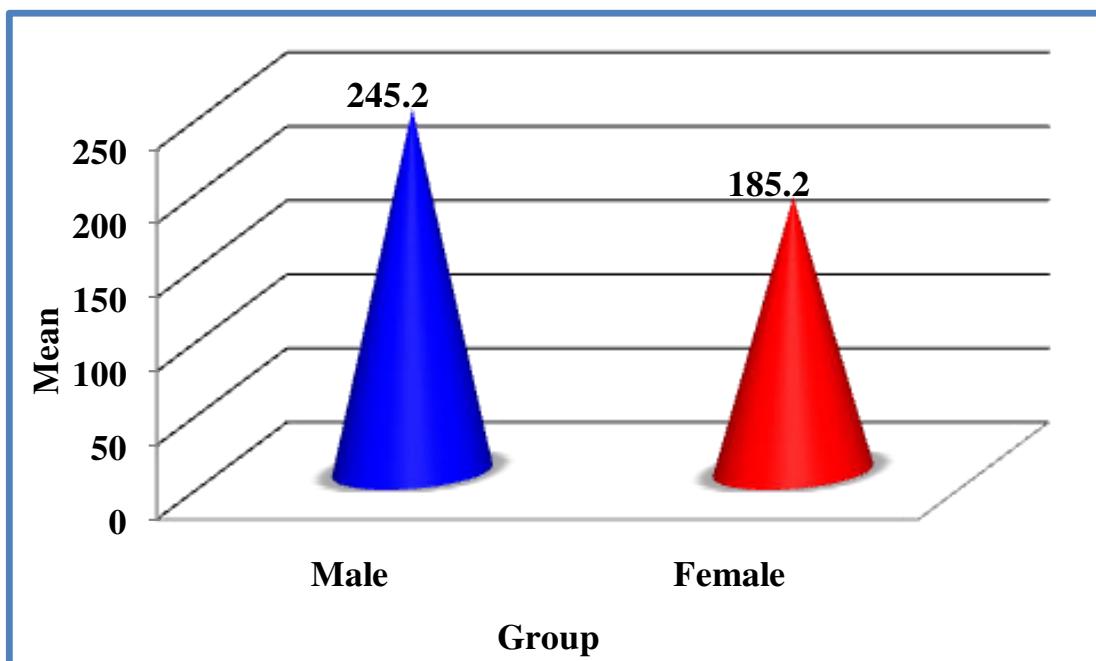
## 8. RESULTS AND DISCUSSION

**Objective-1:** To compare the attitude of male and female Secondary school students of Hassan district of Karnataka towards learning of history subject.

**Table -1: Showing significant difference between attitude of children in male and female Secondary school students group**

Group	Total Sample (N)	Mean	Standard Deviation (SD)	Standard Error (SE)	Difference	df	t- Value	Significance
Male	250	245.2	17.96	1.13	60	498	230	Sign
Female	250	185.2	17.07	1.08				

The Table -1 Shows, the Mean Attitude Score of male secondary school students being greater than that of male secondary school students. Hence, it can be said that the attitude of male secondary school students towards education is more favourable than that of female secondary school students. It may be due to the fact that the male students have realized more the importance of education for their better future.



**Graph- 1:** Showing significant difference between attitude of children in male and female Secondary school students

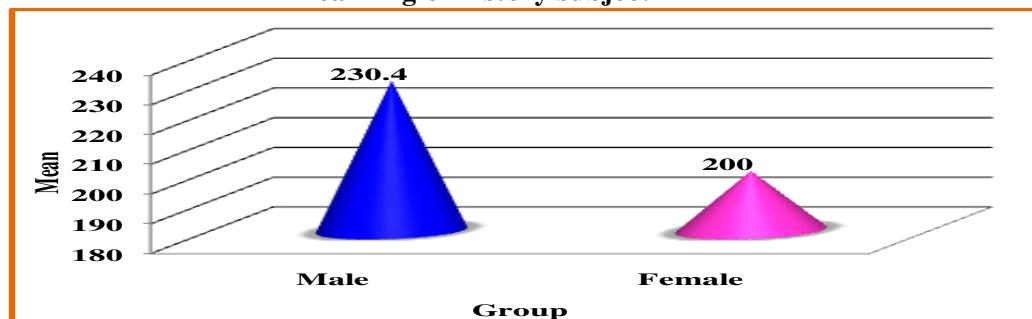
**Objective -2:** To compare the attitude of urban and rural Secondary school students of Hassan district of Karnataka towards learning of history subject.

**Table-2:** Showing significant difference between attitude of urban and rural Secondary school students of Hassan district of Karnataka towards learning of history subject

Group	Total Sample (N)	Mean	Standard Deviation (SD)	Standard Error (SE)	Difference	df	t- Value	Significance
Male	250	230.4	31.89	2.01	30.4	498	109.9	Sign
Female	250	200.0	30.72	1.94				

The Table-2, Shows, at df = 498 the critical value of t at both 0.01 and 0.05 level is 109.9. The obtained value of 109.9 is much more than table value. Hence, Ho2 is rejected and alternative hypothesis accepted. We conclude that there is significant difference between the attitude of urban and rural Secondary school students towards learning of history subject.

**Graph- 2: Showing significant difference between attitude of urban and rural Secondary school students of Hassan district of Karnataka towards Learning of history subject**

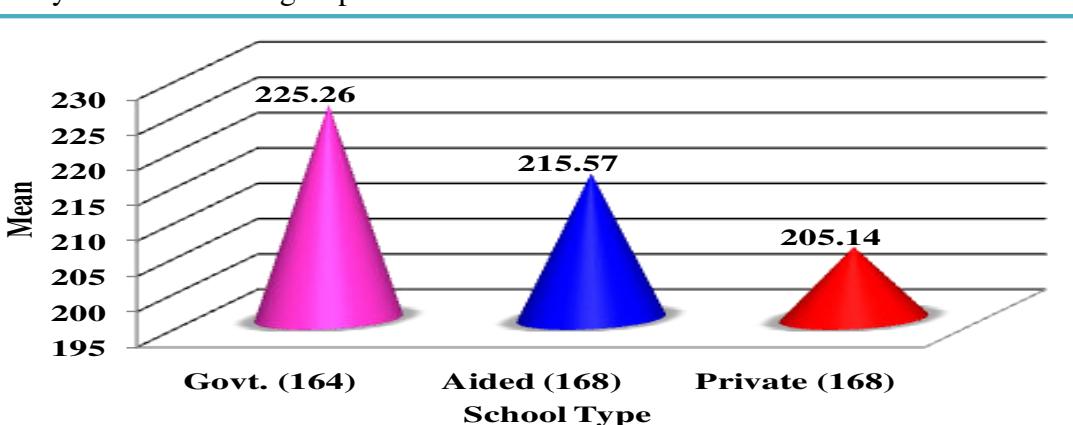


**Objective-3:** To compare the attitude of Govt. Aided and private Secondary school students of Hassan district of Karnataka towards learning of history subject.

**Table-3: Showing significant difference between attitude of Govt. Aided and private Secondary school students of Hassan district of Karnataka towards learning of history subject**

Variable	Type	Mean		Sum of Squares	df	Mean Square	F
School Type	Govt. (164)	225.26	Between Groups	33599.7	2	16799.87	14.64
	Aided (168)	215.57	Within Groups	570023.9	497	1146.93	
	Private (168)	205.14	Total	603623.7	499		

Table-3, Shows that, the obtained F, value of 14.64 is much more greater than table value. Hence,  $H_0$  is rejected. We conclude that there is significant difference between the attitude of Govt., Aided and private Secondary school students towards learning of history subject. The mean attitude score of Govt. school students group being greater than that of aided and private secondary school students. Hence, the attitude of Govt. school students group towards learning of history subject is more favourable than that of aided and private secondary school students group.



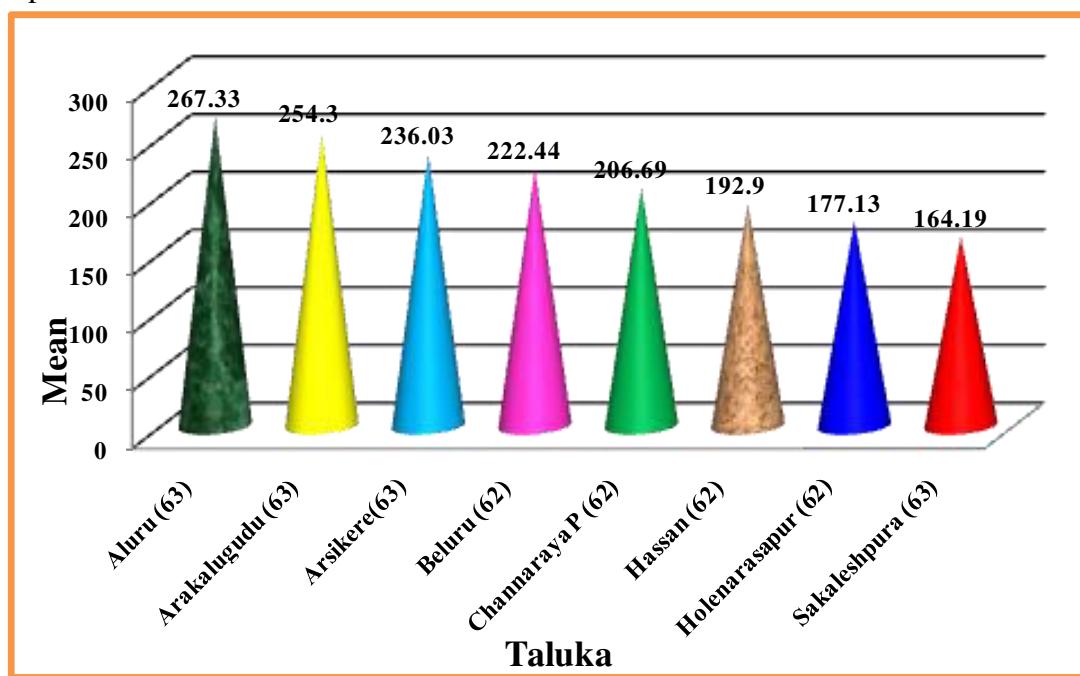
**Graph – 3: Showing significant difference between attitude of Govt. Aided and Private Secondary school students of Hassan district of Karnataka towards learning of history subject**

**Objective-4:** To compare the attitude of different taluka's Secondary school students of Hassan district of Karnataka towards learning of history subject.

**Table-4: Showing significant difference between attitude of different taluka's Secondary school students of Hassan district of Karnataka towards learning of history subject**

Variable	Name of the Taluka	Mean		Sum of Squares	df	Mean Square	F	
Taluka	Aluru (63)	267.33	Between Groups	587230.02	7	83890.00	2517.66	
	Arakalugudu (63)	254.30						
	Arsikere(63)	236.03	Within Groups	16393.73	492	33.32		
	Beluru (62)	222.44						
	Channaraya P (62)	206.69						
	Hassan (62)	192.90						
	Holenarasapur (62)	177.13						
	Sakaleshpura (63)	164.19	Total	603623.75	499			

Table-4, Shows that, the obtained F, value of 2517.66 is much greater than table value. Hence,  $H_0$  is rejected. We conclude that the attitude of different taluka's Secondary school students towards learning of history subject. The mean attitude score of Aluru Secondary school students group is greater than that of all other talukas secondary school students. Hence, the attitude of Aluru Secondary school students group towards learning of history subject is more favourable than that of other talukas secondary school students group.



**Graph – 4: Showing significant difference between attitude of different taluka's Secondary school students of Hassan district of Karnataka towards learning of history subject**



ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

Volume - 3, Issue -11, July 2016

Continuous 35<sup>th</sup> Edition, Page No.: 3981-3988

## 9. CONCLUSION

Results from the present study indicate that attitudes on learning history are indeed an important factor in social studies. Curriculum developers and instructional designers, and also teacher and educators need to consider how to insert effective history method and activities into curricula and plan. It implies the need for fostering favourable attitude and to develop interest among students in the study of science. The necessity for improving gains in the affective areas of learning has also been reinforced and suggested for good academic achievement among the students in future.

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**H.N. Narasingappa, Dr. Smt. N. Laxmi:: A Study On Attitudes Of High School Students Towards Learning Of History Subject In Hasan District Of Karnataka**

3988

# Evaluating Alternative Design For Manufacturing Feasibility And Lower Cost While Retaining Structural Integrity For Suspension Arm

Paper ID

IJIFR/V3/ E11/ 009

Page No.

3989-3998

Subject Area

Mechanical Engineering

KeyWords

Suspension Arm, Altair Hyperworks, Deformation, Stress, Tubular Form, Sheet Metal, Geometry, Stress

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**Abstract**

The identification of the case for this work is now supplemented by the available option of choice of recommended material as also the nature of loads, its magnitude and the boundary conditions of the component. Mathematical treatment is offered to determine the loads experienced by the component while subjected to working conditions. The locations and the relationship of the part with the components connected in its vicinity. The sheet-metal component available as benchmark for this exercise has been analyzed using finite element modeling techniques and the results are studied for inference. The complexity of the sheet-metal part as also the associated costs for its manufacturing has encouraged study to design alternative geometry and form that could take up the requisite loads while also simplifying the process of manufacturing. The new design shall also help to reduce the cost of producing the part validates the new design alternative proposed towards the conclusion of this work.

## 1. INTRODUCTION

The vehicle suspension system is responsible for driving comfort and safety as the suspension carries the vehicle-body and transmits all forces between body and road. From a design point of view, there are two main categories of disturbances on a vehicle namely the road and load disturbances. Road disturbances have the characteristics of large magnitude in low frequency (such as hills) and small magnitude in high frequency (such as road roughness). Load disturbances include the variation of loads induced by accelerating, braking and cornering. Therefore, a good suspension design is concerned with disturbance rejection from these disturbances to the outputs. A conventional suspension needs to be “soft” to insulate against road disturbances and “hard” to insulate against load disturbances. Consequently, the suspension design is an art of compromise between these two goals. There is an increasing interest within the automotive industry in the ability to produce models that are strong, reliable and safe whilst also light in weight, economic and easy to produce.

Recently commercial finite element packages have been readily available and their utility has increased with the development of super computers. The finite element method (FEM) provides a relatively easy way to model the system.

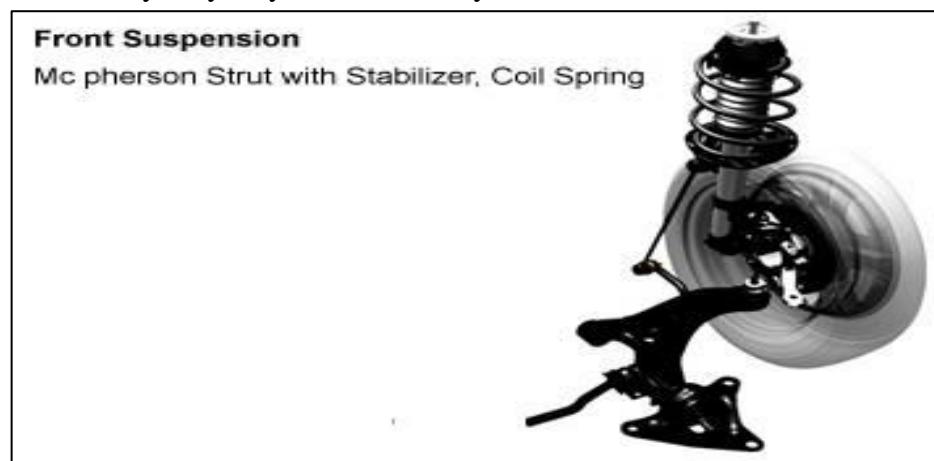


Figure 1: Typical Suspension System

## 2. PROBLEM DEFINITION

The suspension arm or Wishbone or Control Arm in the suspension system of an automobile is required to take up shock loads while the vehicle is in motion. As the component remains in a state of suspension while being hinged between the chassis and the hub carrying the wheel. This part is subjected to stresses on account of the loads acting on its pivoted joints while keeping the wheels from swerving uncontrollable when the road conditions are not smooth, since the design of the part allows for absorbing the shocks while keeping the wheels firmly in place for a steadier ride, the part itself experiences structural challenges to resist failure.

Any instance of failure writes down the goodwill of the company while adding to maintenance bills of the customer. An unforeseen event could expose the occupants

of the vehicle to danger of life and injury as the arm directly controls the swerving of the wheels. A new design variant of the suspension arm needs to be introduced for a premium brand of passenger car. The existing suspension arm could be evaluated as a benchmark component while proposing improved variant complying to the structural integrity with stresses below the tensile yield point of the material.

### 3. OBJECTIVES / SCOPE

- I. To study the working of Suspension arm, material properties, loads connections and its design of the existing model.
- II. Load Calculations and FE modeling of suspension arm
- III. Study the stresses developed in benchmark geometry of suspension arm using CAE software.
- IV. Modify the geometry of existing model by changing the shape or dimensions using optimization tool.
- V. Experimentation testing of Benchmark and Modified Geometry to validate the results obtained from CAE analysis.
- VI. Recommendation of suitable alternative design.

### 4. METHODOLOGY

#### 4.1. Numerical Method / Computational Method:

In pre-processing step, CAD model is imported in .step format. As per geometry, meshing techniques are decided. As suspension arm is sheet metal component having 2 mm thickness DP-590 material properties are given to the component. In material properties, modulus of elasticity in MPa, density in Ton/mm<sup>3</sup> and poisons ratio is given to component. For linear static analysis MAT1 card is assigned to component. Three load cases are considered during analysis as Bump Load, Braking Load and Cornering Load. In this case bump load is considered as abuse load as it is calculated as 3g of the component and acting vertically upward direction. For bumping load case, 4147 N load is applied in z-direction. For braking and cornering load case 2073.55 N load acting on x and y direction.

Material- DP-590

Modulus of Elasticity  $E=2.1 \times 10^5$  N/mm<sup>2</sup>

Poisson Ratio=0.3

Density= $7.9 \times 10^{-9}$  ton/mm<sup>3</sup>



Figure 2: Suspension Arm CAD Model

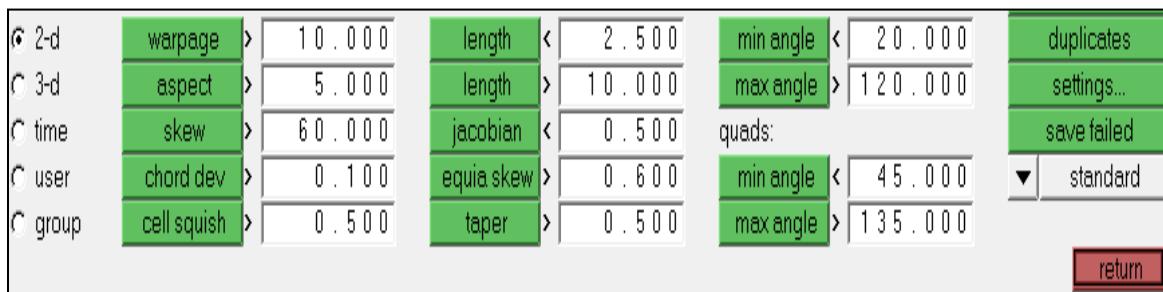


Figure 3: Quality criteria used for meshing element

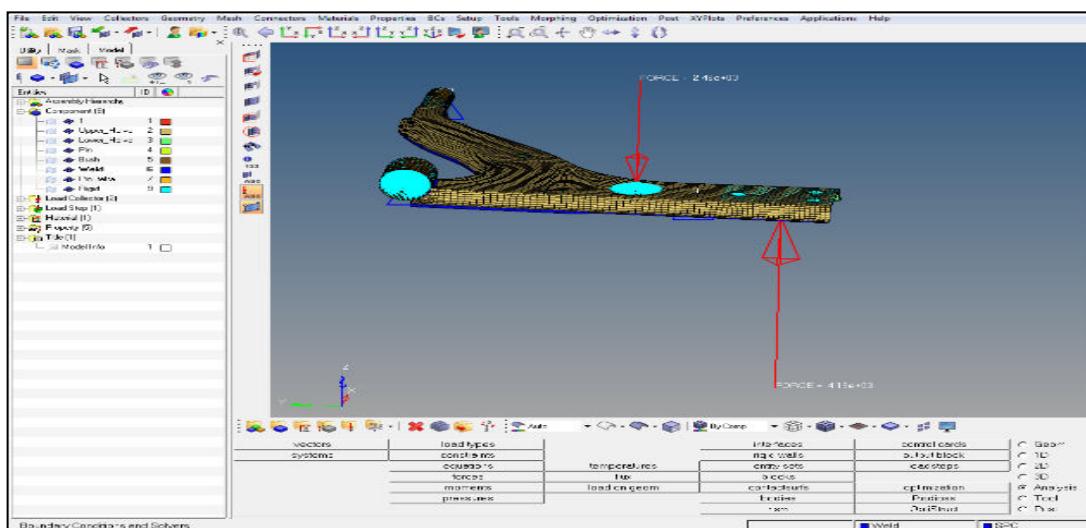


Figure 4: Meshed model of suspension arm in Hyper Mesh interface

#### 4.2 Analysis Result for Benchmark Geometry

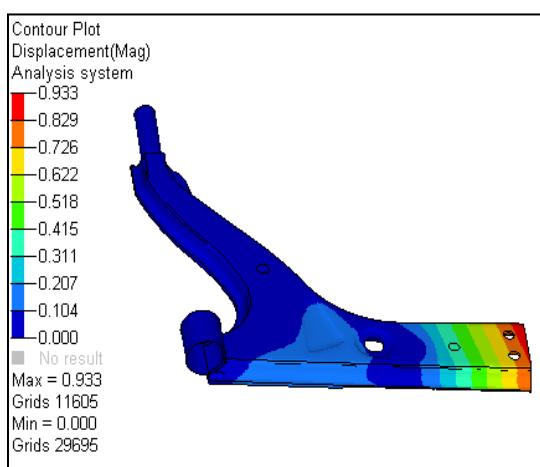


Figure 5: Displacement plot for Bump Load

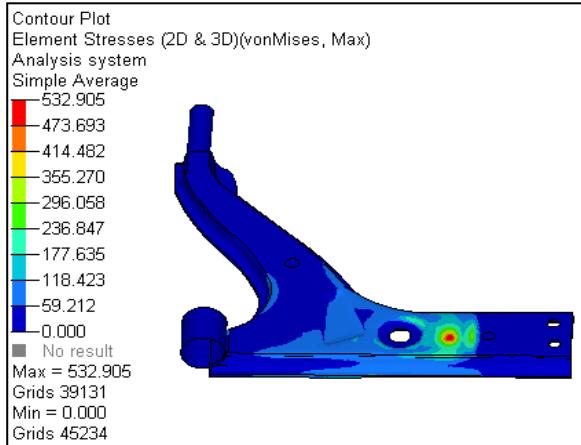
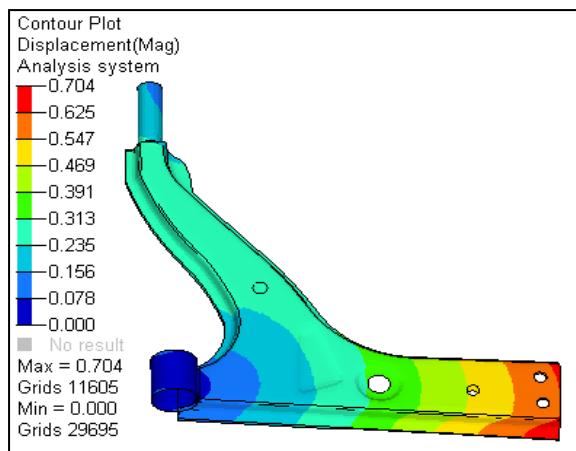
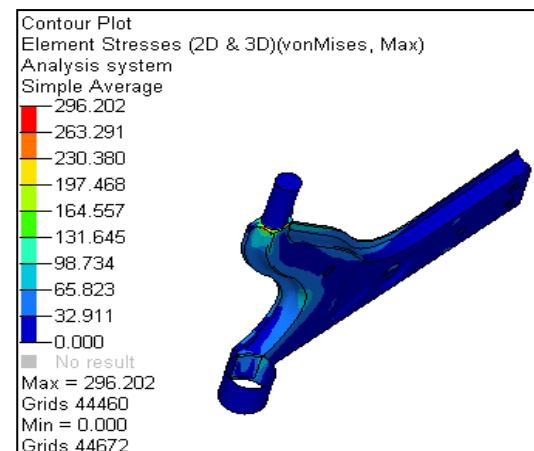


Figure 6: Von-misses Stress Plot for Bump load

Above contour plots depicts the distribution of displacement and Von-misses stresses along the geometry of the component. From above plot, maximum displacement and Von-misses stress for bump load case recorded is 0.933mm and 531.905 MPa.

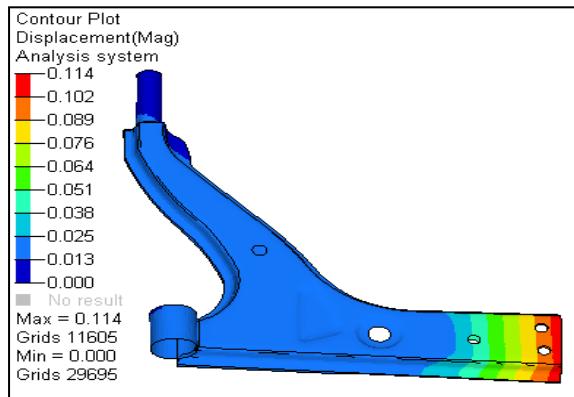


**Figure 7: Displacement plot for Braking Load**

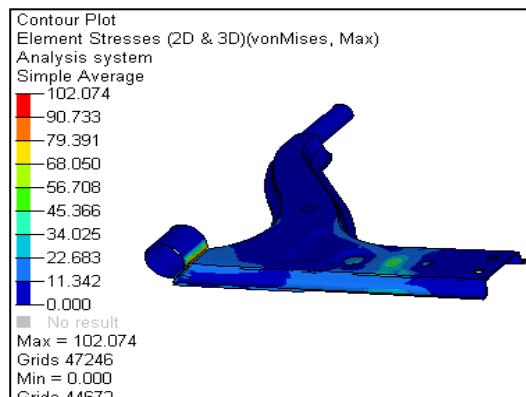


**Figure 8: Von-Misses Stress Plot for braking load**

Braking load case, max. displacement and Von-misses stresses are recorded as 0.704 mm & 296.202 MPa.



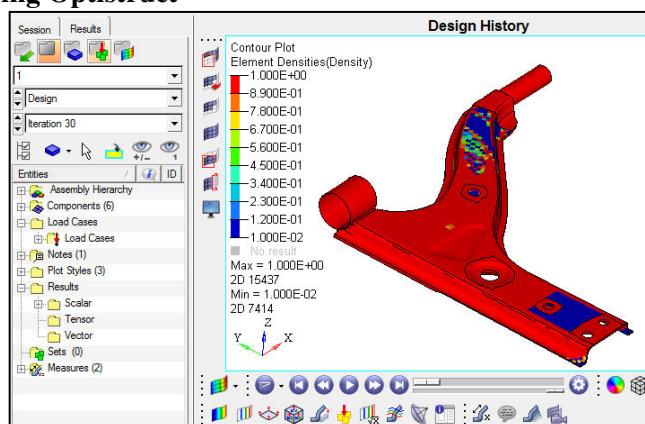
**Figure 9: Displacement plot for Cornering Load**



**Figure 10.:Von-Misses Stress Plot for cornering load**

For Cornering load case, maximum displacement and stress value are recorded as 0.114 mm and 102.074 MPa. Suspension arm is analyzed under various loads from connected parts. Max displacement observed 0.933 mm. Von-misses stress observed 532.91 MPa. Stresses are nearer to yield strength of 550 MPa.

#### 4.3 Optimization Using Optistruct



**Figure 11. Element density distribution Plot**

From above figure blue color is identified for material removing purpose. As the area is small compared to geometry, stress will not reduce and strength of component not get increased if we remove material from this area. Hence new geometrical variant shall be used for further process.

#### 4.4 Modified Geometry

New variant of the suspension arm is shown in fig 12. All FEA steps are carried as same as benchmark geometry. Meshed model with loading condition are shown in below figure. Material properties considered for new geometry is same as that of benchmark geometry. No of elements in this geometry are 47,863 and no of nodes are 94,510.

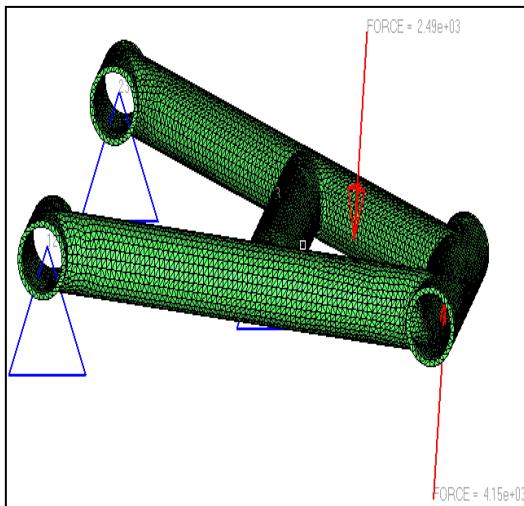
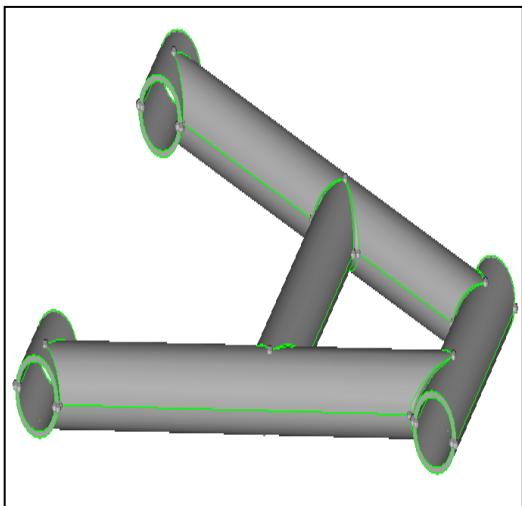


Figure 12: Modified Geometry of Suspension Arm    Figure 13: Meshed Model & Load condition applied on modified variant

#### 4.5 Analysis Result for Modified Geometry

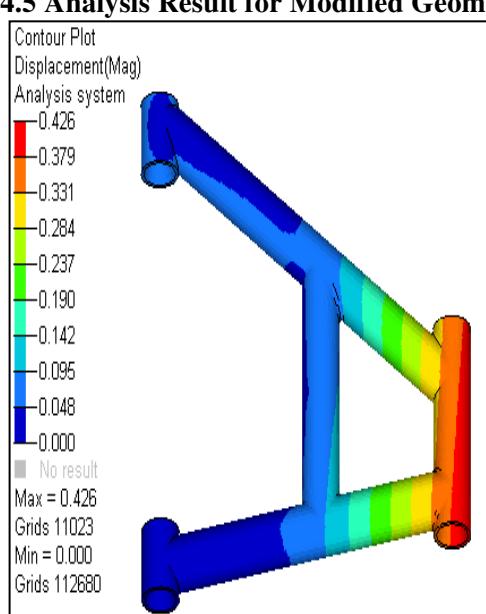


Figure 14. Displacement plot for Bump Load

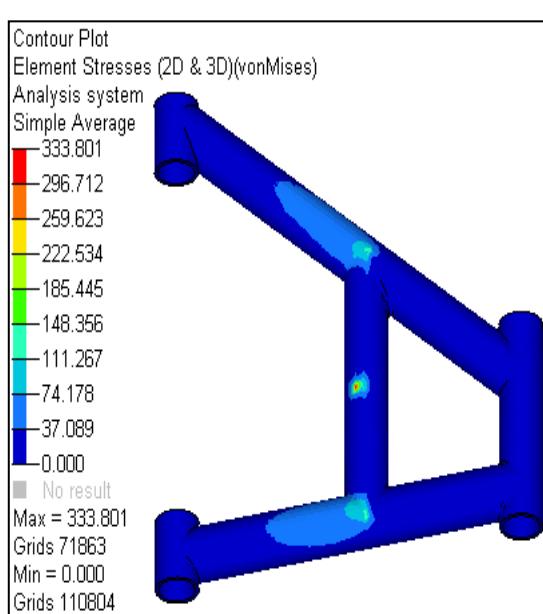


Figure 15. Von-Misses Stress Plot for Bump Load

For Bump Load case, the maximum displacement and von-misses stress value are recorded as 0.426 mm and 333.801 MPa. The max. stress value is located at local region where load is applied.

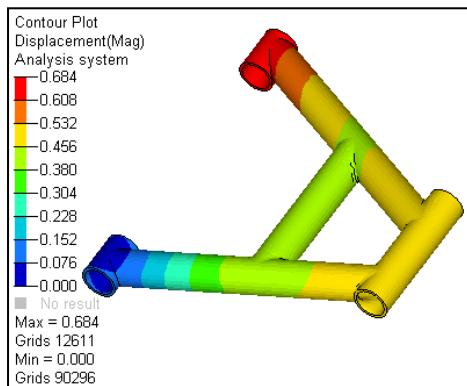


Figure 16: Displacement plot for Braking Load

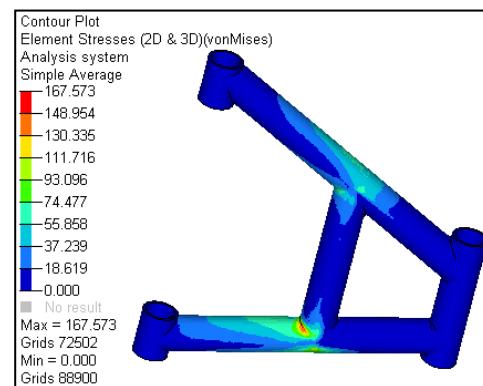


Figure 17: Von-Misses Stress Plot for Braking Load

For Braking Load case, the maximum displacement and von-misses stress value are recorded as 0.684 mm and 167.573MPa.

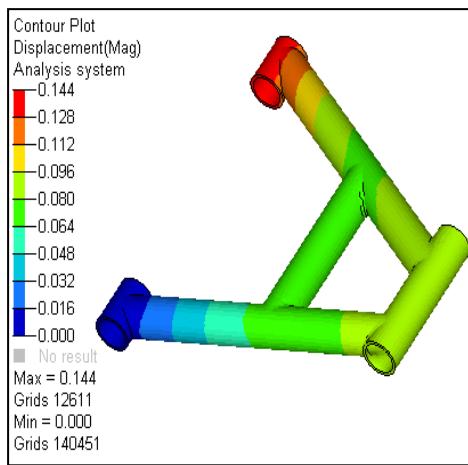


Figure 18: Displacement plot for Cornering Load

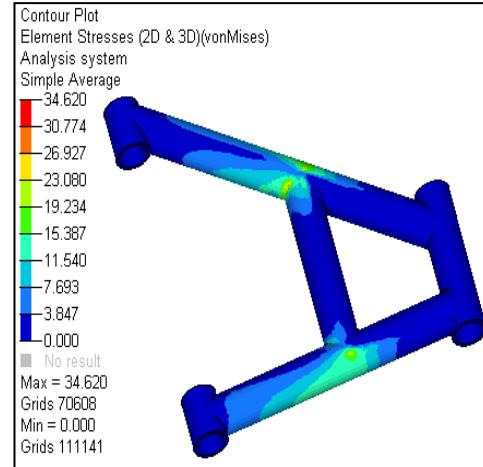


Figure 19.:Von-Misses Stress Plot for Cornering Load

For Cornering Load case, the maximum displacement and von-misses stress value are recorded as 0.144 mm and 34.620 MPa.

#### 4.6 Observation Table

Table 1: Observation Table

Sr. No.	Variant No.		Displacement(mm)	Max Von- Misses Stress (MPa)
1	Original Geometry	Bump case	0.933	532.91
2		Brake	0.704	296.20
3		Cornering	0.114	102.07
1	New Geometry	Bump case	0.416	332.84
2		Brake	0.684	167.57
3		Cornering	0.144	34.62

## 5. EXPERIMENTAL METHOD

The test setup involves Universal Testing Machine with a provision of fixture for the component. Universal Testing Machine is engaged for checking the resistance of the component to tensile and/or shear loads. Stiffness of the component is evaluated using experimental setup.

**Table 2: Experimental Readings for Stiffness of the component**

Sr. No.	Load Applied in N	Stiffness value recorded during Expt. in mm
<b>For Original Geometry</b>		
1	4147	1.007
<b>For Modified Geometry</b>		
1	4147	0.501



Figure 20: Experimental setup for benchmark geometry



Figure 21. Experimental setup for Modified Geometry

## 6. VALIDATION

The experimental results are documented and compared for validating the analytical approach of solving the problem. Validation is sought for the benchmark geometry as well as the revised geometry. The results are compared with corresponding responses determined by Numerical method.

**Table 3: Comparison chart for FEA & Experimentation for Benchmark Geometry**

Load Applied in N	Stiffness value recorded during FEA (mm)	Stiffness value recorded during Expt. (mm)	% variation between FEA & Expt.
4147	0.933	1.061	13.7

**Table 4: Comparison chart for FEA & Experimentation for New variant**

Load Applied in N	Stiffness value recorded during FEA (mm)	Stiffness value recorded during Expt. (mm)	% variation between FEA & Expt.
4147	0.426	0.510	19.8

## 7. CONCLUSION

From benchmark geometry, stresses observed in component are near to yield limit of the

material. During the study for topology optimization, it is difficult to remove the material from benchmark geometry given the manufacturing process originally used i.e. sheet metal forming. The new geometry variant proposed using simple fabrication as the manufacturing method. The new geometry displays substantial improvement in the stiffness of the component.

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ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

**Volume - 3, Issue -11, July 2016**

**Continuous 35<sup>th</sup> Edition, Page No.: 3989-3998**

experience in the domain of R&D, Product Design and Tool Engineering, he has executed projects in the Automotive, Medical and Lighting Industry. His area of interest is Research and Development in the Engineering Industry as well as the emerging sector of Renewable Energy.



**Gayatri R.Rao, Dr. R. J. Patil, Swapnil S. Kulkarni:: Evaluating Alternative Design For Manufacturing Feasibility And Lower Cost While Retaining Structural Integrity For Suspension Arm**

**3998**

# The Aesthetic Function Of The Calypso Style In V.S. Naipaul's Collection Of Sketches, Miguel Street

Paper ID	IJIFR/V3/ E11/ 010	Page No.	3999-4010	Subject Area	English Literature
KeyWords	Calypso, Style, Meaning, Vision, Literary Sketch				

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## Abstract

*The study is based on the assumption that literary style is paramount to literary communication and the meaning we derive out of a work of literature. Literary meaning cannot therefore be divorced from literary style. The purpose of the study is to examine how the style of calypso communicates meaning in V.S. Naipaul's collection of sketches, Miguel Street. The technique of calypso is analyzed to show its aesthetic function in the text. The main objective of the study is to evaluate the text and show how the technique is used by the writer to communicate meaning and artistic vision. The rationale of the study is based on the recognition of Naipaul as one of the best world writers and more important that though his works have received extensive literary attention, little has been done on the aesthetic function of the calypso in the text under study. The study therefore gives a new direction of reading Naipaul's works and thus contributes not only to the understanding of Naipaul's idiosyncratic manner of artistic communication but also to the richness of his literature. The sampled text was purposively chosen based on the aim of the study. The study is grounded in the New Historicism literary theory and more specifically the theory's tenets that emphasize the study of literary works from a historical context.*

## 1. INTRODUCTION

Douglas and Conrad (2009) argue that language is a common tool for all human beings and the different ways in which language is used leads to different results, whether the language is written or spoken. Their general view of language is that it is a tool that performs different purposes depending on the usage. On register they observe that core linguistic features like pronouns and verbs which are functional, are commonly used in association with the communicative purposes and situational contexts. In written texts, they note that these registers could vary from sports, medical fields and even religious fields. In their comparison of the written and the spoken registers and the impact of each to the recipient, they note, there has been less agreement among linguists on how the language of speech compares to the language of writing. In many studies, conversation and academic writing are treated as the two stereotypical registers representing the spoken and written modes (Douglas and Conrad, p. 290).

Douglas and Conrad(2009) further explore how the written genre achieves the varying purposes depending on the context and purpose. They note that there is a big difference between an academic writing where writers employ different registers and when the register is applied in creative writing. The academic registers are highly distinctive in their typical linguistic features, with a frequent use of nouns and technical vocabulary, and extremely complex noun phrase constructions. Unlike all other registers – including creatively written ones – these specialists written registers tend to rely on complex phrases, with relatively few verbs.

In his study on register and dialogue as forms of literary style, William (1958) discusses how register in dialogues can be used to reveal the character of the speaker. He notes that in writing, the purposes of both dialogue and register are similar. Both reveal and define characters in a multitude of ways as well as give much-needed information to the reader. While well-written dialogue advances plot, shapes and interprets the fictional events, and makes important and complicated story development understandable, badly written dialogues will tear down a story.

## 2. LITERATURE REVIEW

- William(1958) pays attention to the purpose of register in dialogues, in a written text. He observes that dialogues provide an opportunity to assess the plot and events that happen in the written text. While he observes the purpose of style in interpreting events and following up in the sequential flow of events, he however does not look at how style can be used to identify themes and asses the aesthetic value of a text.
- As Ngugi(1986) correctly observes, literature does not grow out of a vacuum, it is given impetus and direction by society. Literature reflects societal aesthetics, values and norms. A writer comes from a particular background which shapes his/her perspective and perception of the social and physical environments. This recognition puts history at the centre of many literary texts. In our study of style in



V.S. Naipaul's collection of sketches we focus on the technique of calypso and how it communicates Naipaul's meaning and artistic vision. Literary style is a creation of the individual writer. However as New historicists argue, this style may sometimes be influenced by the writer's background, history and even individual inclinations in terms of religion, ethical beliefs, philosophy among others.

- Scholars and researchers who have studied Caribbean literature point out the unique styles used by Caribbean writers and also the important link between Caribbean literature and the Caribbean history. According to Ramchand (1976), the common experience of colonization, displacement, slavery, indenture, emancipation and nationalism has shaped most West Indies environments, creating a unity of experience that can be identified as Caribbean. Caribbean literature is in the main a product of this experience. Its beginnings in the 18<sup>th</sup> and 19<sup>th</sup> centuries, its explosions in the 1930's and 50's, and its growth into new dimensions in the late 20<sup>th</sup> century reflect the progress of a Caribbean engagement with history, with political and social adjustments and with problems of definition, identity and aesthetics. The concern with the consequences of history, with the social world and its impact on Caribbean sensibility, led almost naturally to another major theme in the 1950's and 60's: the theme of emigration. The concern was a response to a historical phenomenon and a psychological colonial problem.
- Writing about Samuel Selvon's fiction, Ramchand(1970) notes that in Selvon's Trinidad books we see both sides of East Indian life: the close-knit, almost exclusively Indian village communities in the countryside and the more open, less rigid lives of Indians in the urban and sub-urban areas. The idea of emigration is prominent in Selvon's works. However, unlike his fellow Caribbean writer, V.S Naipaul, there is hope in his works. Selvon shows that Trinidad has something to offer to its people. The people are rooted in the land. Selvon is also aware of the white stereotypes but chooses characters who exist outside the stereotypes (e.g. Franklin and Johnson in *Ways of Sunlight*). Ramchand(1970) also notes that use of dialect for both thematic and aesthetic purposes is preeminent in Selvon's fiction. This criticism of Selvon's fiction shades more light on Caribbean literature; its form and content. In the proposed study we specifically examine the link between style and meaning.
- In his study of African Caribbean consciousness, Ngugi(1978) sheds insight into the African Caribbean consciousness in terms of their own history, social conditions and quest for identity in the Caribbean literature. Ngugi makes a link between the concerns in Caribbean literature and those in East African literature. He specifically evaluates George Lamming's novel, *In the Castle of my Skin* and notes how the three-tier structure in the novel's plot communicates Lamming's concerns. Ngugi also examines how the fragmented point of view in the novel communicates Lamming's artistic vision on Barbados. This study is monumental for any study on style and meaning in Caribbean literature.

- Thieme (1981) focuses on calypso allusions in V.S. Naipaul text, *Miguel Street*. The study appreciates how the text is informed by allusions to calypso songs. Thieme(1981) treats the songs as mere literary allusions and not a recurring style in *Miguel Street*. However the paper makes significant observations on the not less than ten calypso allusions identified in *Miguel Street*. He writes:

*Elsewhere the allusions sometimes the prerogative  
of the narrator and sometimes viewed by characters  
within the stores, function as incidental counter-point  
to situations being described (Thieme 1981, p.18)*

Thieme goes on to point out that usually the effect of such allusions is ironic. Most of the calypso at times comes close to the calypsonian's own extremely ironic view of the society. He argues that the calypso tradition furnishes the most significant body of allusions in *Miguel Street* and that Naipaul 's use of such allusions has the effect of firmly rooting the work within the experience of Trinidad's urban black populace.

- Calypso and masking appears in over ten of the seventeen sketches in the book. Apart from quoting ten calypsos in the text, Naipaul also appears to be alluding to others in a more oblique fashion. Writing about the use of the calypso in West Indies literature Babydeen and Wilson-Tagoe(1987) argue that as subject and theme the calypso has functioned in the West Indian literature as a depiction of an aspect of West Indian life, and calypsos have often been evoked to illustrate and confirm observations and judgments held by general mass of the population. They further note that in other Caribbean works, the calypso them feature as delineations of the Calypsonian and a dramatization of the potency, power and traps of his craft. The paper benefits from Babydeen and Wilson-Tagoe(1987) particularly in their appreciation of the role of the calypso in Caribbean literature. The paper focuses on the calypso as style in V.S. Naipaul's *Miguel Street* and examines how the calypso and masking styles communicate Naipaul's concerns.
- Farahmandian (2012) examines the tragedy in the heart of overstated humour in *Miguel Street*. His observations on how the characters live in fantasy and escapism sheds more light on aspects of calypso as a style used in the collection of the sketches.
- Morgan(2005) studies the calypso and its relation to cultural identity in Indo-Caribbean fiction. He observes that the calypso is an icon in Caribbean literature. That it is a barometer of public opinion, a reflector of collective identity and a manifestation of the construction of the individual and communal identity through performance. In terms of verbal dimension, the calypso is one facet of a diverse oral tradition, which has been used by all ethnic groups to express racial antipathy, a deep rooted self-derision and contempt for other through music and childhood rhymes. Indeed the intra-racial and inter-racial diatribes are an extension of the self-contempt and reductive laughter which Caribbean folk art forms, reflecting an historical legacy of ethnic denigration and disempowerment through naming,

democratically employ within the ethnic group and toward other ethnicities (Morgan2005)

- Debydeen and Wilson-Tagoe (1987) observe that V.S Naipaul uses the calypso as both theme and form and that there is a special sense in which its technique as a folk and oral form gives shape to the writings of V.S Naipaul. In this section of chapter four, we examine how the style of calypso is used by V.S Naipaul to communicate meaning in his collection of sketches, *Miguel street*. Indeed as Dabydeen and Wilson- Tagoe (1987, p 75) further observe, in *Miguel Street* the calypso is evoked both as social commentary and as caustic satire because often the very consciousness that its observation and judgments confirm is the consciousness that Naipaul exposes as a negative manifestation of slum life. Often the levity and irresponsibility that York beneath the calypso melody reflects similar qualities in the characters themselves and the similarity explains their continual wish to be linked to those made popular by the calypso.
- In *Miguel street* the calypso style features the calypso theme as delineations of the calypsonian and a dramatization of the potency , power and troops of the craft.In this section we specifically focus on particular sketches that prominently feature the calypso style and communicates the playwrights meaning.

### 3. THEORETICAL FRAMEWORK

The study is grounded in the literary theory of New Historicism. According to Myers(1989) New Historicism is a literary theory based on the idea that literature should be studied and interpreted within the context of both the history of the author and the history of the critic. Based on the literary criticism of Stephen Greenblatt and influenced by the philosophy of Michel Foucault, New Historicism acknowledges not only that a work of literature is influenced by its author's times and circumstances, but that the critic's response to that work is also influenced by his environment, beliefs, and prejudices.

A New Historicist looks at literature in a wider historical context, examining both how the writer's times affected the work and how the work reflects the writer's times, in turn recognizing that current cultural contexts color that critic's conclusions.

New Historicism, then, underscores the impermanence of literary criticism. Current literary criticism is affected by and reveals the beliefs of our times in the same way that literature reflects and is reflected by its own historical contexts. Mikics(2007) notes that Foucault's idea that structures of thought shape everyone and everything within a culture did influence New historicism as a literary theory.



ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

Volume - 3, Issue -11, July 2016

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Veeser(1989) summarizes the tenets of New historicism theory as; interpretation of works of literature from a historical perspective, the appreciation of how the historical context affect the crafting of works of literature, that the writer's artistic vision is affected by time and space, the writer's viewpoint is influenced by his/her historical background, each text is only one example of many types of discourses that reveal history. The study uses these key assumptions and theorizations of the new historicism literary theory to evaluate V.S. Naipaul's text, *Miguel Street* and examine how the techniques of masking and calypso illuminate Naipaul's intended meaning and historical imagination.

*The Aesthetic Function of the Calypso in V.S. Naipaul's collection of sketches, Miguel Street*

In the sketches, **love, love, love, love** and **until the soldiers come calypso** features prominently as style. The titles of the sketches are allusions drawn from the lyrics of particular calypsos. Sometimes the allusions and the calypso as style function as incidental counter-point to situations being described. Usually the effect of the calypso as style is ironic as when Eddoes' girlfriend delivers to him the baby whose father he is supposed to be and Boyee whistles the calypso;

*Chinese children calling me daddy*

*I black like jet*

*My wife like tar-baby*

*And still*

*Chinese children calling me daddy*

*Oh God, somebody putting milk in my coffee (p. 127)*

In this incident calypso as style provides an ironic comment on gender relations, especially man-woman relationship in post-war Trinidad.

In the sketches, **Love, Love, Love Alone**, the relationship between Toni and Mrs Christiani is quite intriguing. Perhaps this rather mechanical relationship reflects and echoes the philosophy and attitudes addressed in other calypso that features In this sketch, **The Maternal Instinct**. In this sketch the calypso goes as;

*Every now and then just knock them down*

*Every now and then just throw them down*

*Black up their eye and b ruiuse up their knee*

*And then they love you eternally (p. 111)*

In the **Maternal instinct** the calypso as style serves both aesthetic and thematic purposes . It becomes a point of reference in supporting Nathaniel's sadistic attitude towards women.

In the above story, Naipaul shows how the degradation of women is only a pose fulfilling the street 's concept of manliness; a perverted concept that is at the same time satirized by the writer himself. The satire comes out clearly when ,ironically, it is Nathaniel himself who is beaten up by his woman.

The battle of the sexes features prominently in calypsos from West Indies. As kunapipi (1981, p. 23) observes, the battle of the sexes has been the most important subject of



the calypsos of the last forty years and it is central in *Miguel Street*. A critical analysis of the different sketches reveal that far from being a collection of only loosely related stories, *Miguel Street* is a carefully crafted critique of the concept of manliness as dramatized in post-war Trinidad.

The opening sketch in *Miguel Street* centres around an inhabitant of Miguel street referred to as Bogart. It is interesting that Bogart imitates an American film star whom the story adopts his name. In this story Bogart has a double persona. Superficially he is silent man who has no need of women or family. It is ironical when it actually turns out that Bogart is a Bigamist.

The sketch ends with Eddoes inquiring from Hat why Bogart left his second wife and went to the street of Miguel. Hat's answer summarizes Naipaul's view on man-woman relationship in post-war Trinidad; 'to be a man among we men' (p16). The calypso style thus communicates the ideal of manliness on Miguel Street and Naipaul's satire of the same.

In the sketch, *The Thing Without a Name*, Naipaul shows that the values that people hold are not values that foster ambition and uplift. The calypso style is used to reinforce his negative attitude and comic satire. Naipaul; reverses the concept of Bogart. Bogart runs away from his wives but Popo the carpenter hero of the story, runs to his wife. He just discovers that he has never been popular in the street as he is to his wife. The calypso that immortalizes Popo is a calypso that sings of the jail sentence, when he acts responsibly he is Shunned as an outsider. When he returns to the fold and becomes a criminal his reputation is re-established and the street proudly links itself to the calypso that sings of his crime.

In *The Thing Without a Name*, the concept of manliness is overtly perverted. Emelda deserts Popo. When popo's manhood is questioned, Hat gives a satirical answer; 'popo is a man- woman. Not a proper man (p. 19). The sketch's irony comes out at the resolution section when Popo is reinstated as one of the boys (p. 25). He steals furniture and paints to renovate his home for Emelda; he is caught and sent to jail. After release, he retains both Emelda and the respect of the street's men.

In *Miguel street*, the calypso style is used to dramatize and communicate the theme of manliness. Indeed this theme appears in no less than twelve of the seventeen sketches. However it is interesting how in some of the sketches Naipaul portrays women as being complacent. Mrs, Bhacku;s cleaning and oiling the cricket bat with which her husband beats her and Mrs Christiani's masochistic obsession with Toni, suggests Women's complicity in the macho ethic preached in calypsos like 'knock them down'. It is however interesting to note that though the calypso style emphasizes the concept of manliness on Miguel street, Naipaul goes ahead to use the same style to satirize the perverted concept of manliness . It is an ironic exposure of the pretence of manliness. In the next section of this concern is explored through the manner in which the writer uses the technique of masking.



ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

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The sketch Until the Soldiers Came dramatizes the impact of the Americans on the values of the people in Trinidad. The calypso's observations about the American take-over is acted out. In this sketch Lord invader sings the calypso first and subsequently Edward's wife mouths the calypsonian's scripted words when he begs her to come back to him; she responds;

*Invader, I change my mind  
I living with Yankee soldier (p. 197)*

This is exactly what happened to Edward. In Until the Soldiers Came the calypso is used to communicate the central theme of the disruption caused by the American military presence in Trinidad in world war II and the Americanization of Hat's brother, Edward.

The power of the Yankee dollar disrupts the traditional pattern of man-woman relationship in Trinidad. Edward marries a modern white wife and claims that he is forced to marry her because she is expectant with his baby, though we know that it is not true. When the marriage proves childless and Edward's virility is impinged, the street's reaction destroys Edward. He becomes not only a victim of the 'tough guy' notion but also a victim of the white man's notion of love. The final straw comes when his wife abandons him for an American.

Edward finally finds himself a living example of the calypso by Invader to which Naipaul alludes in the title of the sketch; 'I was living with my decent contented wife/ until the soldiers came and broke up my life '(pp 185 and 196) Edward cannot withstand the disgrace. He leaves Miguel street and emigrates. The ultimate affront to the street's concept of manliness is when news filters in the streets that his wife has had a baby by an American man.

In the sketch Hat the focus is on Hat who acts as a surrogate father to the child narrator; hat is the father voice in the text and his presence together with that of the boy narrator and the setting of the street are used to create coherence in the sketches. Naipaul uses hat to see through the marks assumed by the other characters:

*I always feel he(Morgan)  
Over doeing everything, I always  
Feel the man lying about\everything, I feel that  
He even lying to himself (p 98)*

But Hat has come to accept life as it is in Miguel street. He says;

*life is a heluva thing. you  
Can see trouble coming  
And you cant do a  
damn thing to  
Prevent it coming. you  
Just go sit and watch  
and wait (p 116)*

Hat's life changes when he brings Dolly home to live with him. The changes are metaphors of Hat's having surrendered his free spirit as a result of having brought Dolly into his life. The calypso echoes that of a perfidious woman:



*Matilda, Matilda,  
Matilda, you thief my money  
And gone Venezuela (p. 210)*

Ironically Dolly leaves Hat for another man. His pursuit of Dolly lands him in jail for three years. When he is released from prison after three years, he finds his friend, boy narrator, grown up. He is now eighteen years old and he has grown psychologically and emotionally. He is able to see through the double persona of the people of Miguel Street. He understands the reality underlying the surface gaiety of Miguel street life.

Ironically, the narrator is no different from the other Miguel street dwellers. He turns to drinking and womanizing. Confronted by his mother, he says; is not my fault. In just Trinidad what else anybody can do here except drink?? (p216).

In *Miguel street* Naipaul uses the calypso style to reveal society as the villain which renders the individual powerless to achieve lasting self-fulfilment. Society has no defined goals to aid its citizens in social mobility and self-fulfilment. The narrator has to be saved from such a society

In the last sketch, **How I left Miguel Street**, the narrator is saved from Miguel street by the mother. He is sent abroad for a metropolitan education. He succeeds where Elias failed. Ultimately this kind of escapism seems to be the only possible road to success to those born in the land of calypso.

*Miguel Street's* main communication is done through the style of calypso and masking. In other sketches such as **The Coward**, **The pyrotechnics and Caution** the central concern of the writer are communicated through the style of calypso and masking. **The Coward** centres on Big foot, the bad John of the street. It is an ironical portrait of the street's bad boy for who carnival and street bands are like ritual and religion. The calypso is his main source of reference and he lives its words, becomes the bully and terror of the street though inwardly he is a frightened little man, He only wears a social façade so as to survive the harsh realities of the street.

In the **Pyrotechnist**, the focus is on Morgan who tries all his life to be a comedian, to stir up laughter. When he finally succeeds it is for something not at all funny. His true nature is exposed. In **Caution** Naipaul celebrates calypso as a spontaneous creative art. News of the end of the World War II and of the coming peace brings on a carnival and a calypso springs out though the song that the inhabitants of the street sing is rather negative not related to the peace.

It is noteworthy that in *Miguel Street* Naipaul uses the calypso style to communicate his meaning and vision. In literature, content and style are inseparable; the implication is that writers deliberately make particular choices of language and literary techniques so as to pass on particular messages to their readers. Style therefore is the writer's instrument of effective literary communication, for both aesthetic and thematic purposes.

In *Miguel Street*, V.S. Naipaul has structured the seventeen sketches in a rather loosely connected pattern with a deliberate purpose of communicating to his readers. These loosely connected sketches are however linked up by use of three main links; the setting of Miguel Street in which all the characters that form the focus of each sketch inhabit, Hat,



ISSN: 2347-1697

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the factor voice of the fatherless narrator and lastly the boy narrator through whose perspective and views we are able to learn more not only about the street but the inhabitants of the street, their values, aspirations struggles and tensions.

The analysis of *Miguel Street* clearly reveals that the style of calypso and masking has in effect contributed to the aesthetic communication of the writer's message and meaning. It is through the style of calypso that we learn of the ironies and absurdities that surround the inhabitants of Miguel Street.

Though the calypso style the writer uses comic and ironic situations that reinforce the satire in the text at the same time communicating the struggles of a people trying to cope up with effects of colonialism and the clash with foreign values. Characters such as Popo' Bogart, Morgan and others become victims of a society descending from European colonialism and western value system. The calypso just like other forms of orator and verbal arts functions as a vehicle of exposing the underbelly of the society portrayed. The writer's aim is to use comic satire through the calypso and thus entertain, ridicule and emphasize the important communication on human values, traits, ironies and how society contributes to the uncertainty in human nature and destiny. In terms of the construction of national unity, the Miguel Street dweller lives side by side, for the most part, blissfully ignorant of markers of ethnic divisiveness. In the Miguel Street world, there is no contestation over national identity. Hat, subtly signalling his potency, is surrogate father to children of all ethnicities whom he proudly instructs in the intricacies of the national game-cricket.

Calypso is the common repository into which all characters chip variously for reference points. Indeed, the calypso is also indicative of patriotism and the good life. Morgan the pyrotechnics turned arsonist sings:

*The more they try to do me bad/  
is the better I live in Trinidad (p.82)*

Calypso in *Miguel Street* becomes a unifying force in its promotion of patriotism and in its construction of the nation as shared homeland. Its barbs and balms are applied in an egalitarian manner to all ethnicities and classes. As a marker of community identity and affirmation, it functions as an indigenous boundary marker.

In his other book *The Middle Passage* Naipaul summarizes how calypso functions in his fiction. This summary goes into summarizing how calypso as a style functions in communicating meaning in *Miguel Street*. Naipaul writes:

*It is only in calypso that the Trinidadian touches  
reality, the calypso is a purely local form.  
The calypso deals with local incidents, local attitudes  
and it does so in local language. (The Middle Passage p 75 – 76)*

Naipaul's observation means that the calypso functions both as style and form in his works. Our analysis of *Miguel Street* confirms that the calypso as style communicates meaning in Naipaul's fictional word as reflected in *Miguel Street*.

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ISSN: 2347-1697

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**Michael Oyoo Weche, Stella Paulinho Kagwira :: The Aesthetic Function Of The Calypso Style In V.S. Naipaul's Collection Of Sketches, Miguel Street**

4010

# Consumer Behaviour - A Study On Visakha Dairy Milk In East Godavari District Of Andhra Pradesh

Paper ID	IJIFR/V3/ E11/ 011	Page No.	4011-4015	Subject Area	Management Studies
KeyWords	India, Milk, Dairy Products, Consumer Behaviour				

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**Abstract**

*India is the world's largest dairy producer. Indian dairy sector has grown substantively over the years. Demand of dairy products in India has increased dramatically in both rural and urban sectors. However, as a larger population is migrating from rural areas to cities. Thus, creates greater demand for milk. The study on consumer behaviour is the study of how individuals make decision towards buying and consumption of milk. The aim of the research was to gain a better understanding of consumer knowledge and attitudes towards milk. The research mainly focuses on the factors like quality, consumer preference, price, service, attitudes and experience of consumers.*

**1. INTRODUCTION**

India is the world's largest producer of milk and also the largest consumer. Milk is not just to drink but its uses go far beyond the dietary and nutritional. Milk and dairy products are the most important source of calcium in children's diet. Children need calcium in their diet for formation and strengthening of bone structure and teeth. Milk is a vital for human growth and development, body maintenance and protection from diseases. So, dairy is currently the top-ranking commodity in India, with the value of output. Dairy is a major part of the global food system, providing economic, nutritional and social benefits to a large proportion of the world's population.

According to the National Dairy Development Board (NDDB), Indian dairy demand in 2021-22 is estimated to be between 200 to 210 million metric tons. Indian dairy





production needs to grow approximately 5 per cent per year in order meet NDDB's 2021-22 demand projection. The Indian dairy sector is estimated to be worth Rs.3.6 lakh crores, according to the Department of Animal Husbandry, Dairy & Fisheries, Ministry of Agriculture, and Government of India.

### Consumer Behaviour

The consumer is the one who pays to consume goods and services produced. As such, consumers play an important role in the economic system of a nation. Consumer behaviour is the behaviour that consumers display in searching for purchasing, using, evaluating and disposing of products and services that they expect will satisfy consumer needs and wants.

Cultural, social and personal factors are always considered to be the major forces influencing consumers' buying behaviour. Culture is the fundamental determinant of a person's wants and behaviour". The distinctive buying patterns and preferences among social classes are significantly determined by occupation, income, wealth, education etc. An individual's values, perceptions, preferences and behaviours in a direct or indirect way are significantly influenced by reference groups like family, friends, neighbours, and co-workers, and often have an effect on their attitudes, products or brand choices. Family is considered to be one of the most important consumer buying groups in the society.

The buyer's characteristics such as age, gender, family size, occupation, income, personality and values have a significant impact on the consumer behaviours and the buying decisions. The consumer's decisions in product and brand choices are greatly influenced by the income level, stability, personality, self-concept, core values and life style.

## 2. OBJECTIVES OF THE STUDY

- To study the satisfaction levels of consumers of Visakha milk
- To know reasons for consume the Visakha milk in East Godavari District.
- To understand the behavioural factors influencing milk consumers

## 3. RESEARCH METHODOLOGY

An opinion survey was conducted to know Visakha milk consumers. Milk, as one category of dairy products, belongs to the group of basic daily-consumed products characterized by relatively high purchase frequency. Andhra Pradesh state is the one of the largest milk producing and consuming states in India. In the state, major milk contributor is Sri Vijaya Visakha Milk Producers Company Limited., (Visakha Dairy), Visakhapatnam in Andhra Pradesh, is having their procurement operations in Costal Andhra districts, viz, Srikakulam, Vizianagaram, Visakhapatnam and East Godavari and sales operations across India. The sample size of this study was 200 respondents in East Godavri District. The questionnaire is prepared through the various levels of satisfaction of respondents. Questionnaire was a research instrument and researcher has taken an adequate care to minimize field errors.

#### 4. ANALYSIS AND INTERPRETATION

The data is analyzed by using the respondent's profile and other behavioural factors influencing the consumer decision process towards Visakha milk. Gender plays a crucial role in purchase decisions. Gender classification is requiring to marketer because different gender exhibits different perception towards products. The table 1 reveals that the majority of the respondents belong to female group.

**Table: 1 Classification of Customers Based on Gender**

Gender	No. of respondents	Percentage
Male	88	44
Female	112	56
Total	200	100

*Sources: Primary Data*

Occupation also influences a person's consumption pattern. The Visakha milk is purchased by various occupants in table 2. Out of the total, majority of the respondents are house wives.

**Table: 2 Analysis of Occupation of the Respondents**

Occupation	No. of. respondents	Percentage
Business	26	13
Employee	44	22
House wife	126	63
Others	04	02
Total	200	100

*Sources: Primary Data*

Income decides the purchasing power of the customer. If the income is high, then they go for high quality irrespective of price of the product. So, income is influence to purchase Visakha milk. As per the data presented in table 3, majority of the respondents' monthly income is below Rs.5000.

**Table: 3 Analysis of Monthly Income of the Respondents**

Monthly income	No. of respondents	Percentage
Below 5000	73	36.5
5001-10000	56	28
10001-15000	43	21.5
15001 & above	28	14
Total	200	100

*Sources: Primary Data*

The various factors such as quality, price easy available etc. are influencing positively on purchasing.

**Table 4: Analyses of Factors to Buy Visakha Milk**

Factors	No. of Respondents	Percentage
Quality	80	40
Brand image	52	26

Price	39	19.5
Easy availability	29	14.5
Others	Nil	Nil
Total	200	100

*Source: Primary Data*

The above table reveals how various factors are influencing on buying of Visakha milk. Out of the total, 40 per cent of the respondents buying for its quality, 26 per cent of respondents use for its brand name, 19.5 per cent of its price consideration and 14.5 per cent of its easy availability.

Consumption quality is varying with various respondents. Some customers buy less quantity and some other huge quantity. It depends upon family size. The table reveals that the majority of the respondents were consuming one liter per day.

**Table: 5 Analysis of Consumption of Average Milk per Day**

Consumption	No. of Respondents	Percentage
1 Liter	142	71
2-4 Liter	37	18.5
More than 4 Liters	21	10.5
Total	200	100

*Sources: Primary Data*

The loyalty towards Visakha milk is to repeat purchase and the customers are satisfied with the products. The following data show the various statuses of the respondents.

**Table: 6 Analysis of Purchase Duration of the Visakha Milk**

Duration	No. of Respondents	Percentage
Below 1 Year	10	05
1-2 Years	30	15
2-3 Years	40	20
More than 3 Years	120	60
Total	200	100

*Sources: Primary Data*

Out of the total, the majority of the respondents are consuming Visakha milk more than three years.

**Table 7: Analysis of Rating towards Visakha Milk.**

Ratings	No. of Respondents	Percentage
Excellent	53	26.5
Good	95	47.5
Average	43	21.5
Poor	09	4.5
Total	200	100

*Source: Primary Data*

From the above table concludes that the majority of the respondents rated Visakha Milk is Good Quality. Only 4.5 per cent of the respondents rated that it is a poor quality.

**Table: 8 Analysis of Value for Money Paid by the Respondents**

Response	No. of Respondents	Percentage
Yes	166	83
No	34	17
Total	200	100

Sources: Primary Data

The data shows that to know what value the consumers are receiving from the Visakha milk. From the above table reveals that majority of the respondents agreed that they are getting the value for money they paid. Only 17 per cent of the respondents feel that they are not getting the value for money what they paid.

Table 9 concludes that the majority of the respondents were satisfied and few respondents were not satisfied with usage of milk.

**Table 9: Analysis of Satisfaction**

Satisfaction	No. of Respondents	Percentage
Yes	189	94.5
No	06	5.5
Total	200	100

Sources: Primary Data

## 5. CONCLUSION

Middle class housewives are the major consumers of the Visakha milk from a long time. However the data shows the consumers buy the Visakha milk for its quality, taste and brand image over than the price. Some of the respondents feel about high price, lack of dealer services. If the company develops marketing programmes such as dealers and outlets, promotion programmers, product lines etc., definitely company can be as a monopoly and strong market leader and, it creates invariant place in minds of consumers.

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# Rural Marketing In India : A Changing Paradigm

Paper ID	IJIFR/V3/ E11/ 012	Page No.	4016-4028	Subject Area	Commerce
KeyWords	Rural Marketing, Rural Customers, Rural Consumer				

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## Abstract

*Rural marketing is a process of developing, pricing, promoting, and distributing rural specific goods and services leading to desired exchange with rural customers to satisfy their needs and wants and also to achieve organizational objectives. The emergence of rural markets as highly untapped potential emphasizes the need to explore them. Marketers over the past few decades, with innovative approaches, have attempted to understand and tap rural markets. Some of their efforts paid off and many markets still an enigma. Rural marketing is an evolving concept, and as a part of any economy, has untapped potential; marketers have realized the opportunity recently. Improvement in infrastructure and reach, promise a bright future for those intending to go rural. Rural consumers are keen on branded goods nowadays, so the market size for products and services seems to have burgeoned. The Indian rural market is a goldmine, which needs to be explored. Rural consumers' behaviour needs to be understood and products specially designed to suit the rural lifestyle. The key business players are ecstatic about the immense market potential in India's rural areas. It is also believed that major changes have taken place in the economic fundamentals, decrease in agricultural dependence, and increase in average income, life style, standard of living of the rural due to high economic growth rate. Business tycoons plan huge investments focused on rural areas, as part of growth of rural strategy. Rural India has witnessed a wave of change in recent times. Rural markets dominate Indian marketing scene and they need special attention for the expansion of marketing activities. With media exposure and increasing literacy levels, people are now demanding a better lifestyle. This paper focuses to study on the concepts and rural marketing in India, rural customers in India, rural population in India, the rural retailing power, tapping the rural market, the changing face of rural consumer, rural marketing strategies in India and the problems and challenges of rural marketing in India.*

## 1. INTRODUCTION

Rural marketing is a process of developing, pricing, promoting, and distributing rural specific goods and services leading to desired exchange with rural customers to satisfy their needs and wants and also to achieve organizational objectives. The emergence of rural markets as highly untapped potential emphasizes the need to explore them. Marketers over the past few decades, with innovative approaches, have attempted to understand and tap rural markets. Some of their efforts paid off and many markets still an enigma. Rural marketing is an evolving concept, and as a part of any economy, has untapped potential; marketers have realized the opportunity recently. Improvement in infrastructure and reach, promise a bright future for those intending to go rural. Rural consumers are keen on branded goods nowadays, so the market size for products and services seems to have burgeoned.

The rural population has shown a trend of moving to a state of gradual urbanization in terms of exposure, habits, lifestyles, and lastly, consumption patterns of goods and services. So, there are dangers on concentrating more on the rural customers. Reducing the product features in order to lower prices is a dangerous game to play. Rural buyers like to follow the urban pattern of living. Astonishingly, as per the census report 2003-04, there are total 638365 villages in India in which nearly 70% of total population resides; out of them 35 % villages have more than 1000 population. Rural per capita consumption expenditure grew by 11.5 per cent while the urban expenditure grew by 9.6 per cent. There is a tremendous potential for consumer durables like two-wheelers, small cars, television sets, refrigerators, air-conditioners and household appliances in rural India.

## 2. CONCEPT OF RURAL MARKETING

The concept of Rural Marketing in India Economy has always played an influential role in the lives of people. In India, leaving out a few metropolitan cities, all the districts and industrial townships are connected with rural markets. The rural market in India generates bigger revenues in the country as the rural regions comprise of the maximum consumers in this country. The rural market in Indian economy generates almost more than half of the country's income. Rural marketing in Indian economy can be classified under two broad categories. These are:

- i.) The market for consumer goods that comprise of both durable and non-durable goods
- ii.) The market for agricultural inputs that include fertilizers, pesticides, seeds, and so on

The concept of rural marketing in India is often been found to forms ambiguity in the mind of people who think rural marketing is all about agricultural marketing. However, rural marketing determines the carrying out of business activities bringing in the flow of goods from urban sectors to the rural regions of the country as well as the marketing of various products manufactured by the non-agricultural workers from rural to urban areas.

To be precise, rural marketing in India Economy covers two broad sections, namely:

- a) Selling of agricultural products in the urban areas
- b) Selling of manufactured products in the rural regions



The rural market in India is not a separate entity in itself and it is highly influenced by the sociological and behavioural factors operating in the country. The rural population in India accounts for around 627 million, which is exactly 74.3 percent of the total population. Conceptually, rural marketing is not significantly different to urban marketing. Marketing manager has to perform the same tasks, but differently in rural marketing. It can be said that marketing is not different, but markets (buyers and users).

In rural marketing, a firm has to undergo marketing efforts to satisfy rural segments, which notably differ from urban segments in some aspects. At the same time, we must note that increasing literacy rate, improved sources of income, awareness due to improved and increased means of communication and transportation, high rate of mobility within and between countries due to liberalization and globalization, and many other such reasons, some customers are likely to be identical.

Even, a few rural customers seem cosmopolitan! So, one can find customers of different behaviour patterns within a village or a town. In the same way, most of products are commonly used in both urban and rural areas. In some aspects, both rural and urban customers behave in homogeneous pattern. Some Indian customers have become global and cosmopolitan!

#### i.) Rural Customers in India:

Rural customers in India do not shop 'just to buy' any longer. They demand brands, and are concerned about quality, and preferences. Indian rural market is growing in an incredible speed. It is commonly believed that rural life is less exciting than its urban counterpart. But, currently rural segment is emerging as a potential market for many big retailers. A report by the associated Chamber of Commerce states that rural consumer market is estimated to grow at the rate of 40%, while urban market sector growth would be only 25%. Earlier people in rural areas were travelling to nearby cities for their shopping requirements. Today, they are easily available in their own places. Media takes most of the credit for this magic transformation, making them more aware and discerning. Television sets are seen in every household, as is the main door. Rural customers get up-to-date information on various brands and the promises they make. Their lifestyle and shopping patterns are going through significant changes, making them more demanding. This transformation will be a key challenge facing Indian retailers.

#### ii.) Rural Population in India:

More than 70% of the sales are made to middle class population, and today more than 50% of the Indian population belongs to the middle class segment. By 2020 urban population in India is predicted by analysts to grow from the current 30.4% to 33.7%. This means that in 2020, 66.3% of the total Indian population will live in rural areas. By the next decade, villages in India will receive lot of development expenses, enriching the rural people. The following figure depicts the distribution of household and income details in India.



Figure 1: Distribution Of household & Income In India

Table 1: The area of household and Population in India.

Area	House Hold	Population
Rural	72.60 %	74.60 %
Urban	27.40 %	25.40 %
All india	100 %	100 %

Indian rural market is growing at 3-4% per annum, adding more than 1 million new rural consumers every year. Increasing income level, and awareness created by electronic media have altered the rural customer, making him to seek better life quality. They are now aware of various brands, and prefer shopping according to their own brand preferences. Products which were earlier considered as 'status symbols' are now being considered as 'must haves'. For a rural consumer, the per capita 30 days of consumer expenses amount to USD 12.34, of which clothing comprises USD 1.

### iii.) The Rural Retailing Power:

Income level in the rural sector sees an increasing trend, and their lifestyles are changing. They are now willing to spend more on goods that are designed to improve their lifestyle. A Neilson report states that by 2025, rural markets would contribute approximately \$100 billion of retail sales. The tremendous growth potential of the rural areas is now attracting the eyes of retailers. With heavy and cut-throat competition in the urban sectors, retailers are chalking out bold strategies targeting the rural consumers in a big way.

Rural customers are now becoming a preferred target for Indian retailers. They are considering options for expanding into the 6.3 lakh odd villages. Starting modern retail formats in the rural areas are likely to revolutionize the shopping habits of rural customers. It is also likely to generate considerable employment opportunities.

### iv.) Tapping the Rural Market Identifying the Rural Mind-sets:

Tapping the Indian rural market needs retailers focus on long term goals. They have to focus on specific geographical areas, and involve in rigorous marketing rather than expanding rapidly all over the country. Indian consumers are noted for their value



ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

Volume - 3, Issue -11, July 2016

Continuous 35<sup>th</sup> Edition, Page No.: 4016-4028

orientation. This distinguishes Indian consumers as discerning, and even luxury brands need to design unique pricing strategies to win a foothold in the Indian rural market. Indian rural consumers are more family oriented, and brands with identities supporting family values tend to be accepted more easily.

Products that communicate emotions and feelings penetrate into the market faster, as Indian rural consumers are more associated with values of care, and nurturing. More women from the rural areas have started working now, and this has opened floodgates for Indian retailers. Rural women of today have come out of her long standing image of homemaker, and is proving equivalent to men. They make their own decisions, thus making one powerful force in the rural market arena. Rural customers have a preference for bold colors. Their status symbols are also different from urban customers. They believe in brands and feel switching their brands might be risky. Today's rural consumers are shaping their life styles influenced by changing mind sets, exposure to western culture, and a craving for self-gratification. Retailers need to come up with simple business models to attract rural customers.

### **3. THE CHANGING FACE OF RURAL CONSUMER**

India is growing at an average annual rate of 7.6 for the past many years and it is expected to continue growing at an equal if not faster rate. The rapid economic growth is increasing and enhancing employment and business opportunities and in turn increasing disposable incomes. The rural consumers in India account for about 73 percent of the total consumers. In recent years, the lifestyle of a large number of rural consumers in India has changed dramatically and the process of change is going on. The buying behaviour of the rural consumers is influenced by several factors such as socio-economic conditions, cultural environment, literacy level, occupation, geographical location, efforts on the part of sellers, exposure to media etc.

As the benefits of growth trickle down, an increasing number of people are moving up from the economically weaker class to join the middle class. The middle class with its rising numbers and incomes is thus becoming the biggest market segment. The affluent class too will continue to grow in terms of size and value, albeit, at a slower pace than the middle class. Most of the companies are going rural because of large and diverse markets, increase in literacy level and changing life style of the people. Even globalization and liberalization expanded the Indian rural market. Rural consumers in emerging markets of developing countries are among the largest and fastest growing segments of the world's population. In a country like India, where a substantial number of the rural people are living below poverty line, having high level of unemployment and poor literacy level; consumer awareness continues to remain low. Above all about 70 percent of India's population lives in rural areas. There are about 6, 38,365 villages in the country as against about 300 cities and 5,161 towns. Of the 121 crore Indians, 83.3 crore live in rural areas while 37.7 crore stay in urban areas, as per the Census 2011. Even in urban areas, a large number of people live in slums whose life is not better than those living in rural areas.



This clearly highlights that India is still dominated by rural population. There were 7,935 towns in 2011 as against 5,161 in 2001. About 13.3% of India's population and 42.6% of urban population reside in 53 cities having more than a million people, while the remaining 7,882 cities account for 47.4% of the urban population. There has been a steady increase in the number of cities from 5 in 1951 to 35 in 2001 to 53 in 2011 having a population of more than 10 lacs. About 31% of the urban population lives in the top-20 cities and about 51% of the country's urban population lives in the top-100 cities.

A report on survey conducted by National Council of Applied Economic Research (NCAER) says that there are 720 million consumers across the villages in rural India. Hence, the development of the nation largely depends upon the development of the rural population. Agriculture is the main occupation of the rural people for their subsistence. It has been observed in the report that the condition of the rural consumers is deplorable because they are being exploited in the rural markets on account of lack of competition among the sellers. Although the rural consumers face various problems like fake brands and spurious products, misleading advertisements, unfair warranties and guarantees, and unreasonable pricing but it hardly affects their passion to buying because they want to buy those products which reflect their prosperity level. Similarly, with globalization and liberalization, rural market in India expanded its potentialities across the world. Globalization describes a process by which regional economies, societies, and cultures have become integrated through a global network of communication, transportation, and trade. Globalization can be defined as the intensification of worldwide social relations which link distant locations in such a way that local happenings are shaped by events occurring many miles away and vice - versa. Globalization generally means integrating our economy with the economy of world. Globalization had its impact on various sectors including agricultural, industrial, financial, health and many others. Globalization has helped in

- Raising the living standards of people,
- Alleviating of poverty,
- Assuring food security,
- Creating a market for expansion of industry and services, and
- Making substantial contribution to the national economic growth.

Globalization has brought in many varieties to choose from i.e. it has given a wide range of products to choose. The rise of rural market has been the most important marketing phenomenon of 1990s, providing volume growth to all leading companies.

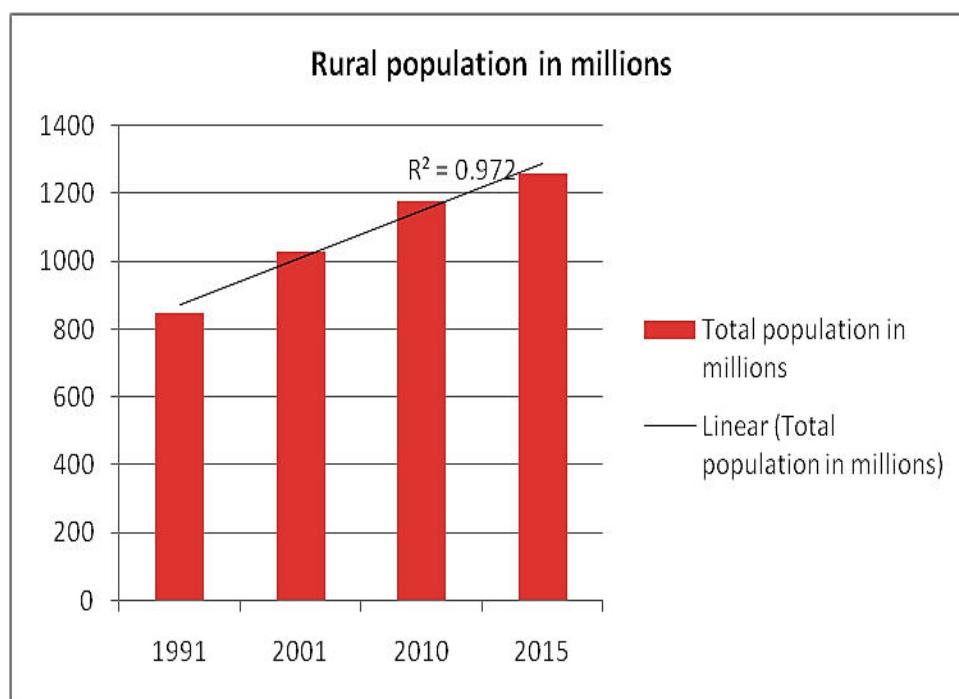
#### i) Why Focus On Rural Consumer?

It is found that companies have expanded in rural areas because they are able to ward off competition, generate a new demand and in turn increase their sales or profits as well. The rural India offers a tremendous market potential. In fact, rural markets are the new markets offering both durable and non-durable products. Long-term perspective of marketing planning with modern approach is essential for their future growth. The Indian rural market is a goldmine, which needs to be explored. Rural consumers' behaviour needs to be

understood and products specially designed to suit the rural lifestyle. The key business players are ecstatic about the immense market potential in India's rural areas. It is also believed that major changes have taken place in the economic fundamentals, decrease in agricultural dependence, and increase in average income, life style, standard of living of the rural due to high economic growth rate. Business tycoons plan huge investments focused on rural areas, as part of growth of rural strategy. Rural India has witnessed a wave of change in recent times. Rural markets dominate Indian marketing scene and they need special attention for the expansion of marketing activities. With media exposure and increasing literacy levels, people are now demanding a better lifestyle.

#### ii) **Changing Dynamics of Rural Markets of India: VISION 2020**

India is one of the fastest growing economies in this world. As the urban markets are nearing saturation in urban markets, corporate are eyeing the untapped rural markets of India for sustainability amidst cut throat competition. Companies are modifying their marketing mix strategies according to the needs of rural consumers. As per 2012 census India has more than 18,000 villages with a population ranging up to 10,000. About 70% of India's total population is rural by nature. Rural India has a population of 83.3 crore spread across 6, 39,000 villages. The rural-urban distribution ratio currently is 68.84% & 31.16% respectively.

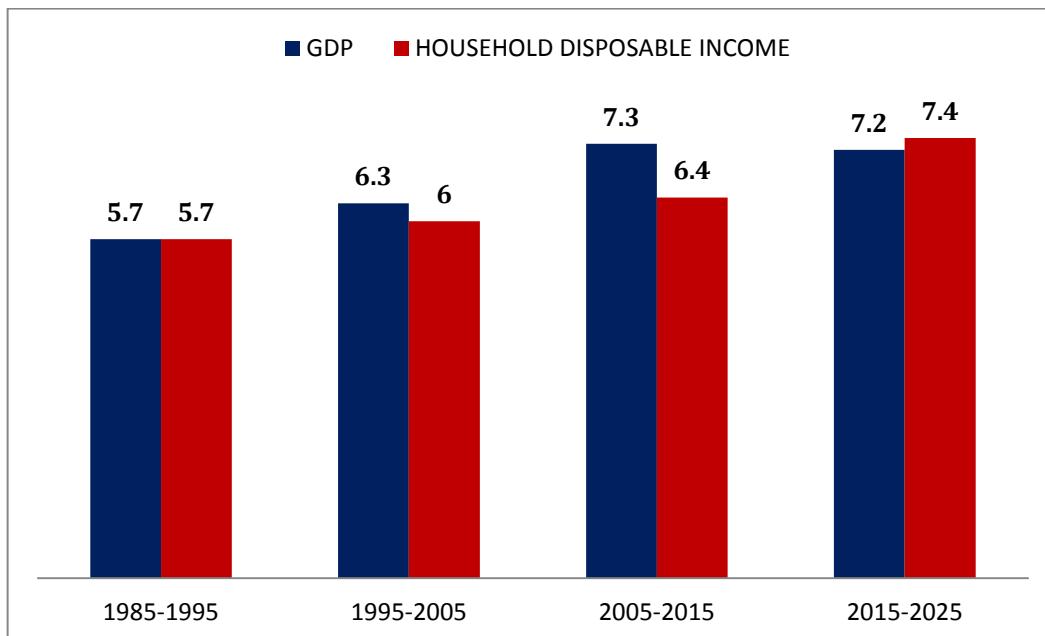


**Figure 2: The Rural Population in India**

**Source:** *Census projections 2001-2015*

The rural population has grown over 200 million over the last two decades as shown in the above Figure. Despite of the income imbalance between urban and rural India, rural holds great potential since 70% of India's population lives there.

**iii) Forecast Of Income Growth And Economic Growth By 2025**



**Figure 3: Increase in economic growth along with income growth till 2025**

*Source: MGI Indian Consumer Demand Model*

As it is evident from the graph India will become a middle class country by 2025. Higher disposable income in the hands of rural households along with massive advertisements by the market players, will take rural FMCG market to over Rs 110, 300 crore by end of 2016. This entails a compounded annual growth rate (CAGR) of 10 per cent in totality for rural and semi-urban areas. Dabur is planning to double its rural reach by rolling out its new rural distribution strategy in 2012. Similarly Godrej Consumer (dealing in hair colour, soaps, toiletries and liquid detergent segments) has also realized the potential of rural markets both in its sales volume and value in rural areas. Paint companies are also now launching low-cost emulsions to suit needs and preferences of rural consumers.

#### **4. SWOT ANALYSIS MATRIX OF INDIAN RURAL MARKETS**

A SWOT analysis matrix has been developed to interpret the challenges and opportunities of rural markets. SWOT analysis matrix contains Strengths, Weaknesses, Opportunities and Threats of Rural Markets. After defining SWOTs of rural markets, Opportunities are compared against Strengths and then Weaknesses to draw SO and WO Strategies. Threats are also compared against Strengths and then Weaknesses to draw ST and WT Strategies. These strategies help out the marketers to tap the rural market, and to combat the threats, and grabbing the opportunities available in rural India. The marketers has to develop a culture like that which calculate these forces comes in the way of rural marketing , and suggest the ways to overcome by forming appropriate strategies on timely manner. The SWOT Matrix has been prepared in this respect for analyzing the rural market is depicted in the following table.

**Table 2: SWOT analysis matrix of Indian rural market.**

Internal Factors	Strengths' (S)	Weaknesses(W)
	S1: Large Indian Rural Population S2: Good Government Support S3: Availability of Products, Raw Material	W1: Lack of good Infrastructure W2: Lack of physical distribution network W3: Low consumption level W4: Less Research and Development activities
External Factors	Opportunities	SO Strategies
	O1: Growing Income Levels of Rural Consumers O2: Growing Literacy Levels O3: Growing quality Consciousness O4: Changing Socio-Economic Scenario	1. Customization of Products according to rural consumer demographics 2. Strengthening of supply chain system with government support and infrastructure 3. Launching of Branded Products in rural markets due to increasing literacy rate and brand awareness
	Threats(T)	ST Strategies
	T1: Increasing Grey Market T2: Growing Competition T3: Less Knowledge levels on Product Identification	1. Educate rural consumers on Product quality and usage 2. Implementation and Amendment of laws /rules/regulations to control the Grey Market 3. Product Awareness using rural media

## 5. RURAL MARKETING STRATEGIES IN INDIA

Rural marketing strategy is based on their A's – Availability Affordability and Acceptability. The first 'A'-Availability emphasizes on the availability of the product for the customers, i.e., this gives importance on effective distribution through efficient channels of distribution.

The second 'A' - Affordability which focuses on product pricing, i.e, this gives importance for smaller packages/pouches easily affordable by families in the rural areas, The third 'A' – Acceptability focuses on convincing the customers to buy the product, i.e., extending suitable promotional efforts to influence the customers to buy the product. Marketers need to understand the psycho of the rural consumers and then act accordingly.

Rural marketing involves more intensive personal selling efforts compared to urban marketing. Firms should refrain from pushing goods designed for urban markets to the rural areas. To effectively tap the rural market a brand must associate it with the same things the rural consumers do.

This can be done by utilizing the various rural folk media to reach them in their own language and in large number so that the brand can be associated with the myriad rituals, celebration, festivals, melas, fairs and weekly hats.

## 6. PROBLEMS AND CHALLENGES OF RURAL MARKETING IN INDIA

At present, three out of four of country's consumers are in rural market and one-half of national income is generated there. A number of corporate units have been trying to get grip on the rural market in a variety of ways. There is no doubt that rural market reveals opportunities and great attraction to marketers. But, it is not as easy as it seems on surface. It is not so simple to enter and succeed in this market in a smooth way. This market poses a variety of challenges, and, therefore, the marketer has to work hard to tackle these challenges tactfully. A company planning to enter and/or expand rural market must consider these problems seriously.

Some of genuine problems associated with rural market include:

- i.) Wide and Scattered Market: Wide and scattered market is difficult to reach in both the aspects – promotion and distribution. Rural India is spread in the entire country in around 6 lakhs villages of different sizes while urban population is concentrated in around 3200 cities. Most of villages are extremely small with population less than 500 people. Only one percent (6300) villages have a population of more than 5000. It is challenging tasks to choose target markets and to serve them effectively.
- ii.) Problem of Designing Products: Products sold successfully in urban markets, may not necessarily be successful in the rural markets due to difference in utility value of the products. Mind-set of rural segments seems quite astonishing and different. Existence of considerable heterogeneity among rural folks poses challenges for marketers to incorporate their uneven expectations in the products.
- iii.) Transportation Bottleneck: Transportation is the nerve centre for any type of business. Most of villages are not properly connected with main roads. Every year during monsoon thousands of villages are disconnected for a longer time. Lack of proper transportation hinders marketing activities. Agro-based products cannot be sent to marketing centers, and industrial products cannot be supplied to rural population safely in time. In certain areas, even construction of road or railway is difficult to construct and maintain.
- iv.) Seasonal and Irregular Demand: Rural demand is characterized as seasonal and irregular. So, companies cannot concentrate on rural segments as it is difficult to plan. In the same way, demand depends on income of rural customers, and income is quite uncertain because they depend on agriculture, and agriculture depends on monsoon.
- v.) Uncertain and Unpredictable Market: Market response is difficult to scale. They don't have stable and predicted behaviour. In such a situation, the effective marketing strategies do not make a sense. Rapid changes are difficult to incorporate and, hence, there are more chances to suffer. Overwhelming response of rural population to some products experiences sudden fall. Market planning remains ever challenging in rural segments.
- vi.) Low Living Standards: Rural customers have low income, low purchasing power, low literacy rate, and, therefore, low standard of living. But, picture is now changing and

marketers can have better opportunities than ever. Low standard of living restricts their buying ability and pace of adopting products.

- vii.) Lethargic Life Style: Lack of desire for a new life style is most critical issue for a marketer. They cannot be easily convinced to try, use and adopt certain products with better qualities and innovative features Product modification does not create desirable and positive effects on rural folks. Customs, established beliefs, superstitions, etc., restrict their behaviour. Unfortunately, their opinion leaders lack scientific approach. Innovative and superior products are difficult to be introduced successfully in rural areas.
- viii.) Language Problem: Language is a main constrains in communication strategies. Multiplicity of languages spoken in rural areas makes marketing activities difficult. Languages differ from state to state, and area to area in the same state. While designing advertising, personal selling, and publicity strategies, marketers cannot fulfill linguistic expectation of all rural people. Promotion programme always lacks versatility.
- ix.) Urban Marketers v/s Rural Customers: The executives in companies cannot understand the consumer psychology of rural markets. Lack of awareness and understanding about consumer behaviour in rural markets create problems in formulating marketing strategies. Rural and urban customers significantly differ in terms of habits, tastes, uses, preferences, and other such aspects. So, any attempt to satisfy rural customers with urban mind (marketing executives born and brought-up in urban climate) results into vain endeavor.
- x.) Backwardness: Rural customers are economically backward. More than 30 per cent of the rural masses live below the poverty line. Poverty confines them to spend even for basic necessities. Backwardness also affects their mentality to change. Their poor purchasing power and rigidity are main constraints for marketers to serve them.
- xi.) High Inventory Costs: Since rural demand is limited and uncertain, an effective inventory management is difficult. Besides, the retailers serving in rural areas don't have adequate knowledge and aptitude to decide optimum inventory. Unnecessary stocks cut their profit margin, and they lose customers in case of inadequate stocks.
- xii.) Inadequate Marketing Support: Normally, producers and wholesalers do not extend full support to rural retailers in terms of liberal credit, financial assistance, and other facilities that they offer to traders of urban areas. In same way, rural customers and retailers are not given adequate space in designing overall marketing programme.
- xiii.) Other Problems: Over and above these problems, there are many minor and major difficulties that rural marketers have to face. Some of them are lack of vision in retailers, ancient and obsolete business techniques, raw and immature consumers, difficulty in segmenting markets, inadequate bank and credit facilities, problems in organizing marketing channels, limited accessibility of media, branding, packaging, and labeling problems, pricing problems and low turnover, etc.

## 7. CONCLUSION

Today, rural consumers are not only buying to fulfill their basic needs but also taking care of higher needs of comfort and socialization. Moreover, they are getting more conscious about health and that they have the extra money to spend on such products. Consumer behaviour which is related to likes and dislikes and expectations of the consumers has changed in recent years owing to enhanced awareness, information technology and more importantly governmental intervention through legislations. The buying behaviour of the rural consumers is influenced by several factors such as socio-economic conditions, cultural environment, literacy level, occupation, geographical location, efforts on the part of sellers, exposure to media etc. Thus, the manufacturers are more cautious in dealing with consumers of their respective products. A recent study by the McKinsey Global Institute (MGI) suggests that if India continues to grow at the current pace, average household incomes will triple over the next two decades and it will become the world's 5th-largest consumer economy by 2025, up from 12th now.

Indian Rural Market play a pivotal role as it provides great opportunities to the corporations to stretch their reach to nearly seventy percent of population. Rural market also benefits the rural economy by providing infrastructure facilities, uplifting the standard, and quality of life of the people resides in rural area. Though the rural market has become a favourite destination for every marketers but it's important to realize that it has lot of challenges and risk, therefore corporations should assess the obstructions as vigilantly as possible. A thorough understanding of rural markets and systematic move towards are necessary to penetrate rural market.

Mahatma Gandhi said, "A consumer is the most important visitor on our premises. He is not dependent on us, we are on him. He is not an interruption to our work; he is the purpose of it. We are not doing a favour to a consumer by giving him an opportunity. He is doing us a favour by giving us opportunity to serve him". Keeping these words in mind, there is an urgent need to address the concerns of the rural consumers and the only way forward is to involve the available constitutional mechanism of Panchayati Raj Institutions.

The future no doubt lies in the rural market. In conclusion, the rural markets are enticing and marketing to rural consumers is exciting. However, a clear understanding or the rural consumers and their current and future expectations are the major part of strategies to tap the rural market nowadays.

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ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

**Volume - 3, Issue -11, July 2016**

**Continuous 35<sup>th</sup> Edition, Page No.: 4016-4028**

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**R. N. Vivekanandar, Dr. P. Rajini:: Rural Marketing In India - A Changing Paradigm**

**4028**

# Emergency Vehicle Detection And Traffic Density Notification System

Paper ID	IJIFR/V3/ E11/ 013	Page No.	4029-4036	Subject Area	Electronics & Communication
KeyWords	Pic Microcontroller, RFID, GSM, IR Sensor				

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## Abstract

Managing the traffic and reducing congestion on roads is an important issue in cities. Traffic junction and traffic police play a crucial role in this regard. The current traffic light system has a static module which turns ON and OFF after a specific duration of time. As the traffic lights work on a static module, they are not capable of counting the density of vehicles on road and recognizing the emergency vehicles like ambulance and fire brigade. This will lead to a situation where some vehicles may have to wait even though there is no traffic on other sides. Also emergency vehicles have to wait till the traffic signal in their road turns green. So this work provides a module of dynamic traffic control system based on the density of vehicles on road and recognizing emergency vehicles automatically based on the RFID tags and clears their way by turning respective traffic signal to green. It also communicates with the driver on request by sending the notification about the traffic incidents and traffic density status in the junction using GSM module. This gives the driver the knowledge of the vehicle congestion of any desired traffic junction.

## 1. INTRODUCTION

Increasing population is increasing the vehicles count at an alarming rate in our cities. But the existing traffic infrastructure has its own limitations to accommodate the exponential growth of vehicles. It is becoming a serious issue to handle the problem of the vehicles on roads majorly on traffic junctions. In traffic junctions vehicles accumulate quickly and traffic jams will occur if the traffic control system is not efficient to manage the vehicles in a faster and smarter way. Traffic lights play an important role in traffic management. Traffic lights are signalling devices that are placed on the intersection points and used to control the flow of traffic on the road. In this proposed work, a model is developed for the traffic density recognition, emergency vehicle recognition and notifying the drivers the



status of traffic in desired roads or junctions. IR Sensors are used to detect the vehicle on the road. The emergency vehicle can be detected by using Radio Frequency Identification (RFID). RFID is a device that consists of three components: RFID Tag, RFID Reader and Database. Each intersection point has its own database. The RFID reader stores the records of all the vehicles that passed through the road. The proposed system provides GSM phone interface to the user, with SMS facility to those who wish to obtain the latest traffic information on congested roads.

## 2. LITERATURE SURVEY

The world's first, manually operated gas-lit traffic signal was short lived. Installed in London in December 1868, it exploded less than a month later, injuring or killing its policeman operator. The first safe, automatic electric traffic lights were installed in the United States in the late 1890s. The rapid growth in the vehicle ownership is one of the measures for economic growth of country. However indirect effect of vehicle ownership is acute traffic congestion. The exploitation of new trends and technologies requires fast transportation of goods, machinery and manpower for various reasons. The work in [1] proposed a smarter traffic control system to distinguish the vehicles based on the priority of the vehicles. Vehicles are divided into four categories of emergency vehicles, school buses, private vehicles and heavy vehicles based on RFID tags attached to it. In [2] method to detect the vehicle on the road is proposed using infrared sensors which acts as an input to the traffic control unit. The work in [3] uses image processing technique and passive sensors to identify the shape of the vehicle. It classifies the vehicle i.e. detect the type of the vehicle using BLOB analysis. The work in [4] proposed an intelligent traffic light controller which uses sensor network along with the embedded technology. In this paper traffic light will be intelligently decided based on the total traffic on all adjacent roads. This will optimize the traffic flow, prevent the traffic congestion.

## 3. METHODOLOGY

The present traffic light control system provides fixed time interval for red and green light. This causes unnecessary waiting time. As the design of proposed system provides dynamic traffic light intersection that will minimize the waiting time of vehicles and also manage the traffic load at the intersection adaptively. This maximizes average number of vehicles passing through each intersection.

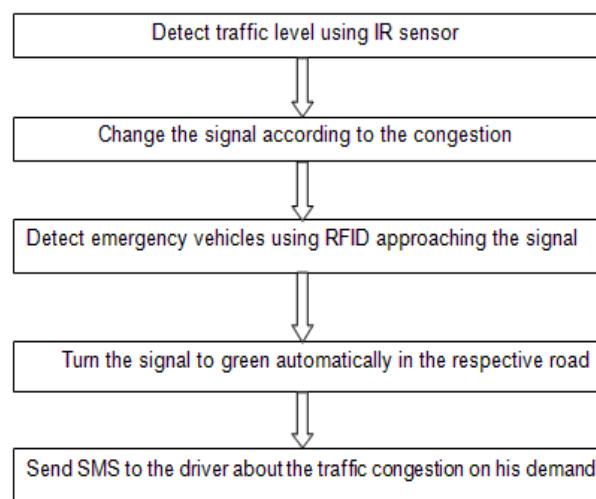
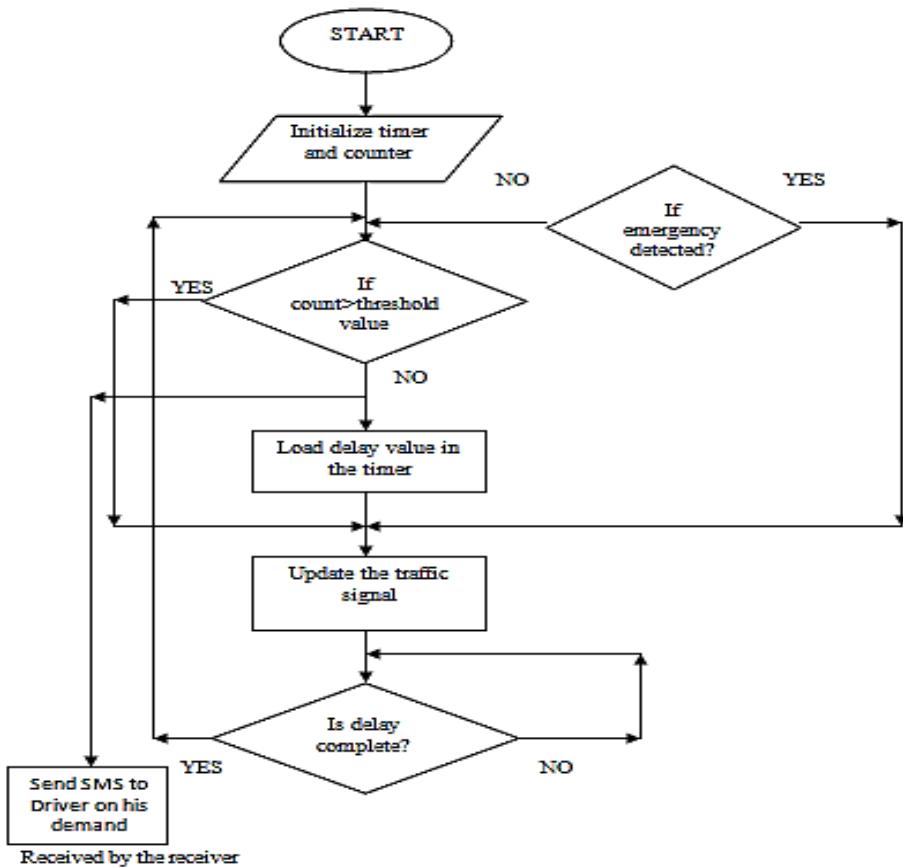


Figure 3.1: Algorithm of proposed methodology



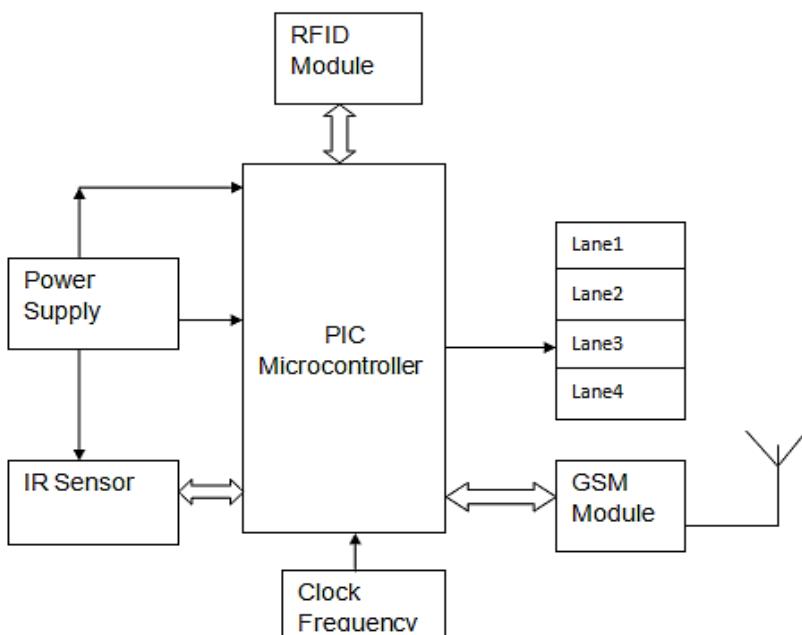
**Figure 3.2: Flowchart of proposed method**

Fig. 3.1 shows the algorithm of the proposed work and fig. 3.2 shows the flow chart of the methodology used in this paper. Multiple Infrared Sensors are mounted on the roads at different distances away from the traffic junction to detect vehicle density on the road at each signal. Counter will be incremented each time when IR rays are blocked by the vehicle. Traffic level will be detected depending on the counter values of all the sensor used in a particular road and provides this as an input to the control system. Microcontroller used in the control system monitors the time period for each Red, Green and Yellow light for which it remains in glowing state depending on the current traffic present at a signal. The priority has been given to the emergency vehicle like ambulance, fire brigade or V.I.P vehicles etc. by glowing Red lights to all the lanes except from the lane where emergency vehicle is passing. This can be implemented by using Radio Frequency Identification (RFID). RFID is a technique that uses the radio waves to identify the object uniquely. RFID tag is inserted into the emergency vehicles. When an emergency vehicle approaches the signal , the RFID reader detects the RFID tag which results in the change of traffic signal in that particular road to green and the signals of remaining roads to red, so that vehicle can pass without wasting precious time.

The proposed system provides GSM mobile phone interface to the user, with SMS facility to those who wish to obtain latest traffic information on congested roads. If vehicle driver sends SMS to the control unit at the junction, the driver will get the message

indicating congestion status of the road. This system will also give information about alternative route to the user by using its database, if present traffic is heavy.

The system has been developed using the sensor assembly along with embedded technology. In power supply circuit the DC pulsating is removed by electrolyte capacitor (1000uF).Our hardware requires 5v DC and hence a voltage regulator of 7800 series is used. A crystal oscillator with 20GHz is used which provides the microcontroller with a frequency clock pulse. Electrolytic and ceramic capacitors are used which removes the ripple and cancels the noise. Output of power supply is given to PIC microcontroller.



**Figure 3.3: Block diagram of Emergency Vehicle Detection and Traffic Density Notification.**

### 3.1 Microcontroller PIC16F877

PIC16F877 as shown in fig. 3.4 is one of the most advanced microcontrollers which are widely used for experimental and modern applications because of its low price, wide range of applications, high quality and ease of availability. It has special features like RISC CPU, up to 368\*8 bits of RAM, 256\*8 of EEPROM, 8K\*4 of flash memory. PIC16f877 has 5 basic input/output ports. PORTA is 6 bits wide, PORTB, C and D with a width of 8 bits. And PORTE has only 3 bits wide.



**Figure 3.4: PIC16f877**

### 3.2 RFID (Radio Frequency Identification)

Fig. 3.5 shows the RFID technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal or person. RFID is coming into increasing use in industry as alternative to bar code. RFID consists of 3 components, which are antenna, Transmitter and receiver. **Figure 3.5: RFID reader and tag** Low frequency RFID systems have frequency range of 30 KHz to 500 KHz, High frequency RFID system have frequency range of 800MHz to 950MHz and 2.4GHz to 2.5GHz.



### 3.3 GSM

Fig. 3.6 shows the GSM module which is a digital mobile telephony system that is widely used throughout the world. GSM uses a variation of time division multiple access (TDMA). It digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its time slot. It operates at either the 900MHZ or 1800MHZ frequency band.



**Figure 3.6: GSM model used in the project**

GSM is considered a second generation (2G) mobile phone system. There are mainly two type of service offered through GSM: Telephone and data. Telephone service is mainly voice service that provide subscriber with the complete capability to communicate with other subscriber. Data service provides the capacity necessary to transmit appropriate data signal between two access points creating an interface to the network.

### 3.4 IR Sensor



**Fig. 3.7: IR sensor circuit**

The Infrared sensors shown in fig. 3.7 are one of the most basic and popular sensor modules in an electric device. These sensors are parallel to the human's visionary senses, which can be used to detect obstacles. IR Sensors are used to measure the speed of object moving at a very high speed. Principles used in ALL Infra-Red proximity sensors are same.

### 3.5 Power Supply

Fig. 3.8 shows the circuit diagram of power supply. It consists of a transformer with primary and secondary windings which are linked together through inductively coupled electrical conductor. From the main, 230V AC voltage applied to step down transformer to convert to 12V AC voltage. It also consists of a bridge rectifier which converts both the positive & the negative half cycle into DC i.e. 12V AC voltage from the transformer into 12V DC voltage. Output of rectifier is provided to a voltage regulator to convert varying input voltage into a constant regulated output voltage. The voltage regulator used here is IC7805. It supports an input voltage of 10 volts to 35 volts and output voltage of 5 volts. This 5V is given as input to the PIC microcontroller.

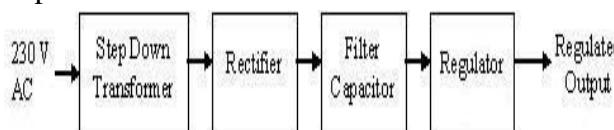


Figure 3.8: Block diagram of fixed regulated power supply

## 4. RESULTS

Multiple IR sensors mounted on road detects the traffic level. This is given as the input to pic microcontroller. Microcontroller turns the green light ON in the respective road where highest traffic density in measured by the sensors. Traffic lights in the remaining roads will be automatically turned OFF for specific duration of time. Fig. 9 shows the setup of smart traffic light system. Here the threshold value of vehicles is given as 10. If more than 10 vehicles are detected by the sensors in a particular road, yellow light will be turned ON. It will turn ON the red light signals in rest of the roads and turns ON green light where the traffic density is measured.

Fig.3.10 shows the RFID reader mounted 150m away from the junction. Whenever emergency vehicle containing RFID tag nears the reader, a signal will be sent to microcontroller circuit which will turn ON the green light in the respective road.

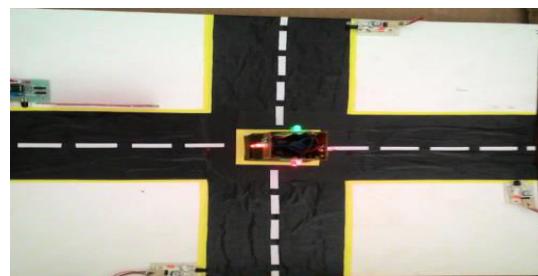


Figure 3.9: Hardware Setup of traffic junction with IR sensors

This setup also uses the GSM module attached to the controller circuit. Driver can send the message to know the status of traffic density in a particular junction to this GSM module. A message will be sent back to the mobile of driver notifying the current density of all the roads in a junction which is measured by the IR sensors. Message sent notifying the number of vehicles in a junction is shown in fig. 3.11.

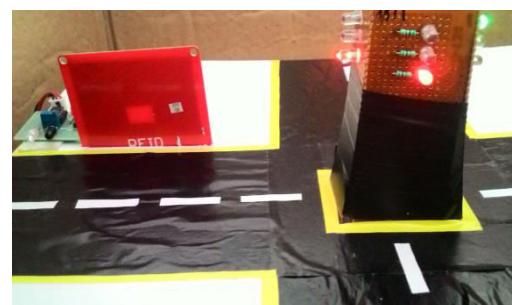


Figure 3.10: RFID reader

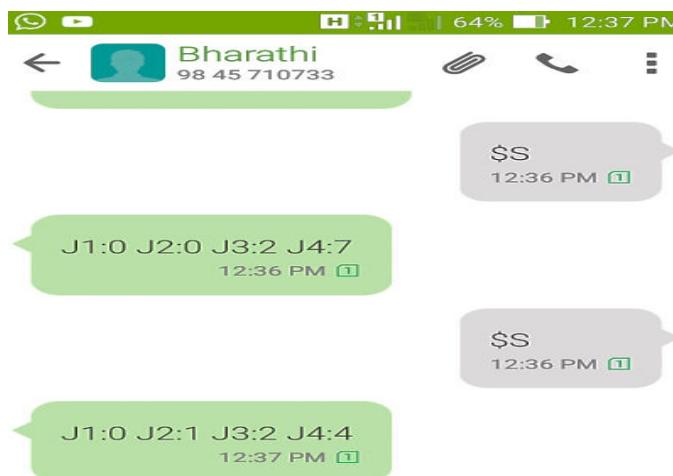


Figure 3.11: Message Notification

## 5. CONSLUSION

The proposed system has been developed using the IR sensors along with embedded technology. The proposed work considers the priority of the vehicles on road and traffic density of vehicles and controls the traffic light sequence effectively and accurately. Emergency vehicles are detected using RFID tags which automatically sends signal to the respective traffic signal to turn the Green light ON. The accuracy of the RFID is more than camera's. It also sends notifications through messages regarding the traffic density status of a required junction and possible alternative roads to the drivers using its database and GSM module. It will help the commuters to know about the congestion in the road they are travelling and options to take the alternative routes. In this project smartness of traffic signal controller is introduced with powerful functions and hardware interface. Proposed system works efficiently over the present traffic controlling system with respect to less waiting time, efficient operation during emergency mode and suggesting alternate route.

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Sachin Bhat received his BE degree in the field of Electronics and Communication from AITM, Bhatkal and M.Tech degree in Digital Electronics and Communication from NMAMIT, NITTE, Karnataka. He has more than 5 years of industrial and research experience and currently working as Asst. Professor in the Dept. of ECE in SMVITM, Udupi. His research interests include Digital Image Processing, Pattern Recognition, Paleography, Neural network and C++ design.

## An Analytical Technique To Design The Face Gear

Paper ID	IJIFR/V3/ E11/ 017	Page No.	4037-4042	Subject Area	CAD / CAM
KeyWords	Design, Face Gear, Tangential load, Beam strength				

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### Abstract

This paper gives the analytical technique to design face gear used in spinning mill. The faces used in the spinning mill are get fail due to tangential load coming on the tooth. This is due to improper use of the material of gear. The gears are made up of ordinary cast iron. The basic stress is very low, i.e. the allowable stress. By replacing the gear material the with high grade cast iron, which have allowable stress greater than the ordinary cast iron. This paper gives the detail analytical technique of design the face gear used in high spin spinning machine. The faces are manufactured by the process of shaping. The tooth loads are causing the failure of gear during working. The beam strength of the previous material of face gear of the tooth is calculated and new material strength is calculated.

### 1. INTRODUCTION

Gears are one of the most critical components in mechanical power transmission systems. For reducing the noise level and power transmissions, the face gears are used. The bending and surface strength of the gear tooth are considered to be one of the main parameters for the failure of the gears. For optimal design of gears and to reduce their failures, the stresses are becoming increasingly important. All the analytical investigations would be carried out on the basis of Lewis stress formula. Face gears typically have a straight or skewed tooth line and varying tooth profile in normal cross section at different radii from major to minor diameter. These face gears are engaged with spur or helical involute pinions at intersecting or crossed axes.

**About Hi- Spin Ring Spinning Frame Machine:-** Texmaco –Hi-Spin Ring Spinning Frame is designed and manufactured to run at the highest obtainable spinning speed in the

industry with ring and traveller combination .However ,to fully utilize the design and manufacturing potentials of this machine careful handling by the operator is essential.

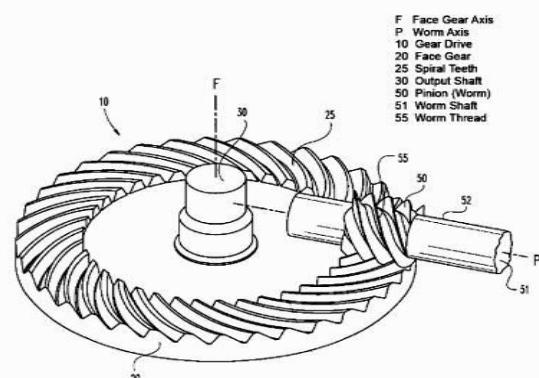
## 2. REVIEW OF LITERATURE

The previous research works addressing gear analysis published by some author is as follows,

- I. Pravin M. Kinge et.al, have analysed gearbox used in sugar industry. The main objective of analysis was to improve the life of the gear. The reason found for failure of the gear was due to wear of gear teeth edges. This is caused due to high stress concentration along gear teeth edges. To relieve these stress concentration three modifications in the design were done using ANSYS and again stress analysis of the modified gears carried out. The three design modifications were done as first, the edges of the gear teeth were tapered by an angle of 200, second, making groove in the gear wheel and third, making holes at the roots of the gear teeth. They have proved that the expected increase in life of the gears of the gearbox would be three years.
- II. Gitin M. Maitra, V.B. Bhandari, PSG College of Technology, Norton, P. C. Gope, M. F. Spotts et.al, have explained all the details of every type of gear including geometry, gear related parameters, force calculations, deflections, effect of heat generation, stress concentration, design criterion, load rating and efficiency of gears, friction in worm gears, material selection and strength rating of worm gears in their respective books

## 3. DESIGN OF SPIRAL FACE GEAR

The design of the face gear for power transmission in spinning machine play an important role. These gears are moving the bobbins in upward and down ward direction. This is give data of spinning machine and required parameter to fulfil the design requirement.



Motor power =  $P=15\text{ kW} = 20 \text{ HP}$ .

No. of teeth on pinion =  $t_p = 10$

No. of teeth on gear =  $t_g = 43$

RPM of pinion =  $N_p = 20$

RPM of gear =  $N_g = 15$

V.R. =  $N_p/N_g = 20/15 = 1.333$

Module =  $m = 5.5$

#### **Step No.1 - Pitch diameter of gear & pinion**

$$D_g = m \times t_g = 5.5 \times 43 = 236.5 \text{ mm}$$

$$D_p = m \times t_p = 5.5 \times 10 = 55 \text{ mm}$$

#### **Step No.2 - Pitch angle $\Upsilon$ of gear and pinion**

$$\tan \Upsilon_p = D_p / D_g = 55/236.5 = 0.2325$$

$$\Upsilon_p = \text{Pitch angle of pinion} = \tan^{-1} 0.235 = 13.10^\circ$$

$$\tan \Upsilon_g = D_g / D_p = 236.5/55 = 4.3$$

$$\Upsilon_g = \text{Pitch angle of gear} = \tan^{-1} 4.3 = 76.9^\circ$$

#### **Step No.3 - Pitch line velocity**

$$V_p = \frac{\pi \cdot D_p \cdot N_p}{60 \times 1000} = \frac{\pi \times 55 \times 20}{60 \times 1000} = 0.05759 \text{ m/s}$$

**Step No.4** – The power of motor is = 15 kW and RPM is 1440. This power is transmitted by whole gear train at various RPM. So we are taking the ratio of power input to the power output at pinion . the pinion RPM is 20

The power required to drive the pinion is given by  $= \frac{15 \times 20}{1440} = 0.2083 \text{ kW}$

$P_d$  = design power

$$P_d = P_p \times K_l$$

Where  $K_l$  = load factor, for steady load and continuous duty.

$$P_d = 0.2083 \times 1.25 = 0.26041 \text{ kW}$$

$$\text{Tooth load} = F_t = P_d / V_p = 260.41 / 0.05759 = 4521.90 \text{ N}$$

$$\text{Radial load} = F_r = F_t \times \tan \phi \times \cos \Upsilon_p = 4521.9 \times \tan 20 \times \cos 76.9 = 373.03 \text{ N}$$

Where  $\phi$  = pressure angle =  $20^\circ$

$$\text{Axial load} = F_a = F_t \times \tan \phi \times \sin \Upsilon_p = 4521.9 \times \tan 20 \times \sin 76.9 = 1603 \text{ N}$$

#### **Step No.5 – Beam strength, $F_B$ , N**

$$F_B = S_0 \times C_V \times b \times Y \times m \times ((1 - (b/L)))$$

Where ,

$F_B$  = Beam Strength (N)

$S_0$  = Basic stress of material =  $S_0 = S_{yt} / 1.5 (\text{N/mm}^2)$

$C_V$  = Velocity factor

$b$  = Face width of gear

$Y$  = levis form factor based on virtual no. of teeth

$m$  = module

L = cone distance

(1-b/L) = Bevel factor

$t_f$  = formative teeth

$$t_{f(p)} = t_p / \cos Y_p = 10 / \cos 13.1 = 10.26$$

$$t_{f(g)} = t_g / \cos Y_g = 43 / \cos 76.9 = 189.71$$

Y = lewis form factor for involute gear, for 20° full depth type of profile

$$Y_p = 0.485 - (2.87 / t_{f(p)}) = 0.485 - (2.87 / 10.26) = 0.2052$$

$$Y_g = 0.485 - (2.87 / t_{f(g)}) = 0.485 - (2.87 / 189.71) = 0.4698$$

$$\text{Cone distance} = L = \sqrt{\left(\frac{D_p}{2}\right)^2 + \left(\frac{D_g}{2}\right)^2} = \sqrt{\left(\frac{55}{2}\right)^2 + \left(\frac{236.5}{2}\right)^2} = 121.40 \text{ mm}$$

The material of gear is malleable cast iron, having basic stress =  $S_0 = 56 \text{ MPa}$

The material of pinion is forged carbon steel having  $S_0 = 245 \text{ MPa}$

$$(S_0 Y)_g = 56 \times 0.4698 = 26.30 \text{ MPa}$$

$$(S_0 Y)_p = 245 \times 0.2052 = 50.27 \text{ MPa}$$

$(S_0 Y)_g < (S_0 Y)_p$  Hence pinion is strong and gear is weak

$C_V$  = Velocity factor =  $3/(3+V_p)$ ---commercial cut and velocity 2.5 - 5m/s....DDB page no. 166

$$C_V = 3/(3+V_p) = 3/(3+0.05759) = 0.9811$$

b= 46mm

$$F_B = S_0 \times C_V \times b \times Y \times m \times (1 - b/L)$$

$$= 56 \times 0.9811 \times 46 \times 0.4698 \times 5.5 \times (1 - (46/121.4)) = 4055.9 \text{ N}$$

$F_B < F_t$  i.e.  $4055.9 < 4521.9 \text{ N}$ . hence, gear is fail.

In order to increase the beam strength the suitable material is select, which having basic stress more than the existing material stress of gear.

So the material is selected cast iron high grade

$S_0 = 105 \text{ MPa}$

For that material, calculate the beam strength

$$F_B = S_0 \times C_V \times b \times Y \times m \times (1 - b/L)$$

$$= 105 \times 0.9811 \times 46 \times 0.4698 \times 5.5 \times (1 - (46/121.4)) = 7604.8 \text{ N.}$$

Here  $F_B > F_t$  i.e. the material selected is suitable for the given application

So this material is select for gear to avoid failure.

#### Step no.6- Dynamic load calculation, $F_d$ , by using Buckingham's equation

$$F_d = F_t + \frac{21V_p(Ceb+Ft)}{21V_p+\sqrt{Ceb+Ft}}$$

Where,  $F_d$  = dynamic load (N)

$F_t$  = Tooth load (N)

$V_p$ =Pitch line velocity (m/s)

C = Deformation Factor

e= sum of the error between two meshing teeth (mm)

$$C = \text{Deformation Factor} = \frac{a}{\left(\frac{1}{E_p} + \frac{1}{E_g}\right)}$$

Where,

a = constant depend on the form of teeth

a = 0.111 for 20° full depth

E<sub>p</sub> = 203 GPa

E<sub>g</sub> = 77 GPa

$$C = \frac{0.111}{\left(\frac{1}{203 \times 10^3} + \frac{1}{77 \times 10^3}\right)} = 6196.57 \text{ N/mm}^2$$

e = 0.06 ---- from the DDB on page 165, the graph show the module verses probable error.

$$F_d = F_t + \frac{21V_p(Ceb+Ft)}{21V_p + \sqrt{Ceb+Ft}} = 4521.9 + \frac{21 \times 0.05759(6196.5 \times 0.06 \times 46 + 4521.9)}{21 \times 0.05759 + \sqrt{6196.5 \times 0.06 \times 46 + 4521.9}} = 4698.29 \text{ N}$$

#### Step no.7 - Limiting wearing strength, F<sub>w</sub>,N

$$F_w = \frac{KbDpQ}{\cos \gamma_p}$$

Where,

K = Load stress factor

b = Face width

D<sub>p</sub> = Pitch diameter of pinion

Q = Ratio factor

$$Q = \frac{2 \text{ tf(g)}}{\text{tf(p)} + \text{tf(g)}} \quad \text{----- DDB page 180}$$

$$= \frac{2 \times 189.71}{10.26 + 189.71} = 1.8973$$

K = 1.376 ....from DDB on page 168

for cast iron and steel, 20° involutes full depth, with pinion 250 BHN and Gear 180 BHN

$$F_w = \frac{1.376 \times 46 \times 55 \times 1.8973}{\cos(13.1)} = 6781.51 \text{ N}$$

Since F<sub>w</sub> > F<sub>d</sub> Hence it is safe for continuous duty.

#### Step No.8 - Bending stress calculation , σ<sub>b</sub>

$$\sigma_b = M \times y / I$$

M = Maximum bending moment, Ft × h

h = height of tooth

y = half of the thickness of tooth (t) at radical section = t / 2

I = moment of inertia about the centre line of tooth = bt<sup>3</sup> / 12

$$\sigma_b = \frac{Ft \times h}{bt^3 / 12} \times t / 2 = 6 \text{ Ft} \times h / bt^2$$

$$\sigma_b = 6 \times 4521.9 \times 11 / (46 \times 8.6) = 87.72 \text{ N/mm}^2$$

### Standard Proportion For Face Gear

- 1) Addendum =  $1m = 1 \times 5.5 = 5.5$  mm
- 2) Dedendum =  $1.2 m = 1.2 \times 5.5 = 6.66$  mm
- 3) Clearance =  $0.2m = 0.2 \times 5.5 = 1.1$  mm
- 4) Working depth =  $2m = 2 \times 5.5 = 11$  mm
- 5) Thickness =  $1.57 m = 1.57 \times 5.5 = 8.63$  mm
- 6) Outside diameter = pitch diameter +  $2 a \times \cos Yg = 236.5 + 2 \times 5.5 \times \cos 76.9$   
 $= 239$ mm
- 7) Inside diameter =  $239 - (2 \times 46) = 147$  mm

### 4. RESULT AND DISCUSSION

This is the live problem of failure of face gear of spinning machine at Indira Sahakari Sutgirni M.I.D.C. Wardha. As per the inspection and the load consideration the gear fails due to bending. The fatigue failure occurs in the gear. This failure can be avoid by using the high grade Cast iron, IS grade 35 which having basic stress more than present material of gear.

### 5. CONCLUTION

In this project work, the failure of face is due to the tooth load. Another load i.e. axial load and radial load is less as compare to tooth load. Due to the tooth load the stress develop in tooth is more that why gear fail. Due to gear fail, the machine is in break down stage, So the production is hamper. To avoid breakdown it is very important to chance the material of gear.

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# Complementarity With New Rural Policy Through National Education Policy

Paper ID	IJIFR/V3/ E11/ 018	Page No.	4043-4055	Subject Area	Education
KeyWords	Rural Education, Indian Higher Education, New Rural Policy, Prominent Features, Characteristics, Classifications, Challenges, Rural Well Being				

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**Abstract**

A literature review shows that issues regarding rural education are arbitrarily common & universal. Basically India is agriculture based country. About 80% of India's population lives in villages. In spite their being in majority, they have been lagging behind in the fields of education, civic amenities, medical facilities & economic wellbeing. Presently it is a big issue in India. Coping with the rapid changes in international economy-globalization, improved communications & reduced transportation costs, changing trade patterns for commodities & the emergence of important non-farm activities in rural regions, it became necessary to understand the New Rural Policy (NRP). It was interesting to find out the inputs from New Rural Policy for rural youth, in the context of 'demographic dividend' in India. It was decided to analyse the New Rural Policy document with the objective to find out the prominent features of the document & their educational implications. The study excludes the details of implementation of policy, case studies in NRP. A skill based education is suggested for rural area. A distance mode & use of e-learning would be useful for remote rural learners. Assessment studies & process evaluation would be useful to find out the gaps of rural development programs.

**1. INTRODUCTION**

Rural education is older, still real issue to discuss. Many individuals & organisations have worked hard throughout their careers to improve rural education. However, rural education has remained a back burner issue for top national policy makers & philanthropies.<sup>1</sup> As is a global issue, India also suffers from the same. Moreover, the nature of problems are also similar. For example, Access to education. Access to education varies around the world, UIS & UNESCO (2015) estimate that on an average the out of school population is roughly twice as large in rural areas as it is in urban areas (16% &



8%) respectively.<sup>2</sup> Outmigration is another issue. Rural areas suffer from the outmigration of both young & highly skilled workers. This leads to an aging population & strained public services.<sup>3</sup> Lack of awareness about job market, funding, parental attribute, low skill, low wage labour are some other issues. Although rural population is being in majority, they have been lagging behind in the fields of education, civic amenities, medical facilities & economic wellbeing. The prominent features of NRP & their educational implications to Indian rural higher education were as follows-

- Agriculture is not the main source of income & several rural regions perform in line of urban for economic growth.
- 3 types of rural areas are observed-FUA1, FUA2 & FUA3. According to the type, they have different challenges.
- Average difference of Education indicator is statistically significant between group 1& 4 across urban & rural area. Key national policies such as health care, education, innovations & others would benefit significantly from receiving guidance from rural development policy.

## 2. RATIONALE FOR THE STUDY

Being a practitioner in education field through state government & working with government educational schemes, observed rural education keenly. Basically India is agriculture based country. Number of rural development schemes, models is executed from post-independence period. Still periodical dynamic changes, natural disasters & many other factors may hamper agriculture related economies leading to economic crisis & victimising farmers. It's very urgent need to focus on the problem. Thinking on rural education starts with M. Gandhi which is creative, original, revolutionary, skill development & based on social needs. India has a very favourable dependency ratio & it is estimated that, the average age in India by the year 2020 will be 29 years. It means 60% of the population will be in the age group of 15-59 years highest in the world.<sup>4</sup> To reap the benefits of 'demographic dividend' the XII<sup>th</sup> plan favoured the creation of a comprehensive National Skill development Mission. With this context of economic crisis & unemployment in rural area it was decided to analyse the new rural policy published by OECD.

## 3. BACKGROUND OF THE STUDY

To proceed further it was decided to review the rural education at global level. Some related to the issues are as presented below.

- i.) Young people in rural areas are much more likely to be idle- meaning not engaged in education, training, not working & not earning regular income. This problem is especially acute for high school dropouts & for native Americans.<sup>5</sup>
- ii.) The need for research & evaluation of practice in rural education is likely to increase as more accountability & results are expected from public investments in education.<sup>6</sup>

- iii.) The Global Education Review (GER) is focussed on rural education because the disparities between children living in urban & rural areas remain such a persistent issue in so many countries.<sup>7,8</sup>
- iv.) Not only the number of children who remain out of school staggering, but progress in reducing these numbers has stagnated since 2007 & in many countries, children living in poor, rural areas are among the most affected.<sup>9</sup>
- v.) Despite compulsory schooling in China....parents reported being relieved when their children wanted to quit school because of the financial burden .....admire the youngsters who are making money by working in the city.<sup>10</sup>
- vi.) The youth in rural areas will need to be trained to cater to the demands of the latest jobs available in the private sector. ITIs & polytechnics, which are the pioneers in providing technical human resources to the public sector, have outdated curricula that do not link effectively with the existing job market. Therefore new & flexible training solutions will require a major restructuring of TVET system & how it is managed.
- vii.) Schools & college education needs to be more oriented to preparing students for life, including the world of work. This will require the curriculum to lay emphasis on developing key skills such as communication, critical thinking & other life skills. India has lagged behind in the area of technical & vocational education & training.<sup>11</sup>
- viii.) Many schools need to raise their standards & become fully integrated in to telecommunication networks.<sup>12</sup> The review points can be summed up as follows:
  - a. Rural education has similar type of issues generally in all countries.
  - b. The common issues affecting rural education are early dropouts, out migration, lack of awareness about career options, parental attitude, poor educational practices, disparities between urban & rural living.
  - c. India has similar issues as observed in other countries. The prominent are underemployment, lack of latest job level skills, outdated curricula mismatching the market needs.

#### **4. OBJECTIVES OF THE STUDY**

- I. To analyse the content in the document New Rural Policy.
- II. To find out the prominent features in the document New Rural Policy.
- III. To determine the educational significance of the prominent features of NRP with the present status of the Indian Higher Education.

#### **4. DELIMITATIONS OF THE STUDY**

The entire document is not analysed but the way, the concept of rural has developed, its characteristics & classification of rural, challenges being faced, characteristics of well-being are considered content wise. This is because for this paper, the limited content was found to be sufficient to fulfil the objectives of the paper.

## 5. METHODOLOGY

A qualitative method -document analysis was used. It is a systematic method of reviewing & evaluating the document both printed & electronic (computer based & internet transmitted) material. Here data is the content of document. It is examined & interpreted to elicit the meaning. It is simplified to get meaning understood.

## 6. ANALYSIS & INTERPRETATION

Considering the nature of the study, it was decided to analyse the data manually. A paper-pencil coding was used to analyse the data. To represent the themes & central ideas, appropriate words, phrases, simple & short sentences were marked. Graphics, tables, graphs were used for data on averages, percentages, figures for easy understanding.

**DATA ANALYSIS** - Analysis of descriptive data is made page wise & paragraph wise. A word, short phrase assigning summative, salient, essence- capturing attribute was used to represent content in the paragraph. A schematic representation used, wherever possible. Figures were adapted to simple understanding. The page is then interpreted below its analysis.

Table 1: Page & Paragraph wise analysis of Chapter 1

Sr. No.	Page & Para No.	Point	Understanding
1	2--1	Foreword	Radical change : Typical subsidy → Investment strategy
2	2--1	Foreword	10 <sup>th</sup> rural conference--- direction of future work
3	2--2	Quote	Success → mobilization of place based assets

### Observation-

- i. A radical change in NEW RURAL POLICY, 2006 was Investment strategy instead of typical subsidy program for specific sectors.
- ii. The document is about the direction of future work.
- iii. A quote by OECD secretary general about success in rural region was mobilizing the place based assets by communities.

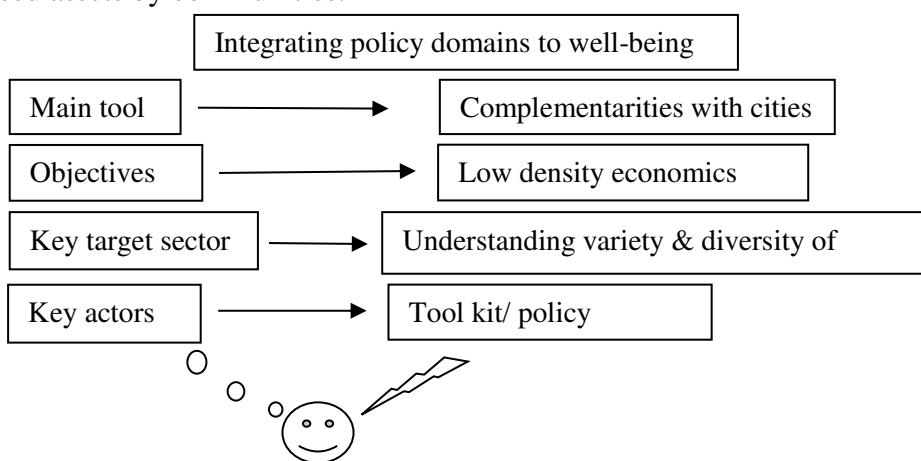


Figure 1-The New rural policy- thinking

**Observation:** On thinking the new rural policy well-being, low density economics, complementarities with cities, understanding variety & diversity of places were the points which came out.

**Table -2: Introduction**

Sr. No.	Page & Para No.	Point	Understanding
1	4--1	Introduction	Generating economic growth, job opportunities in low density regions.
2	4--2	Advancing policy	Statistical evidence- agriculture is not main source of income Rural regions perform in line of urban for economic growth
3	4--3	Advancing policy	Large amount of information, Involvement of sub-central entities required.
4	4	Bold message	Rural is not agriculture & economic stagnation

**Observation:**

- i. It was realised by financial crisis that, generating economic growth & job opportunities in low density regions was a key priority.
- ii. Policy analysis showed that, agriculture is not the main source of income, many rural regions perform in line of urban for economic growth.
- iii. The shift towards urban resemblance requires large amount of information & Involvement of sub-central entities.
- iv. Rural is not simply agriculture & economic stagnation.
- v.

**Table -3: Beyond the Paradigm**

Sr. No.	Page & Para No.	Point	Understanding
1	5--1	Beyond the paradigm	NRP- obsolete?, basic paradigm-relevant?, modifications? Stakeholders: NRP- remains pertinent & yet fully embraced
2	5--2	Beyond the paradigm	Role of OECD : help members to develop & adopt policy, evaluating its working, affecting factors, shaping the change
3	5--3	Beyond the paradigm	Next work : last 10 years work, change in members perspective about achieving, evolution of SES, integrating policy in broader governance

**Observation**

- i. Feedback about policy working from stakeholders is that, it is pertinent & fully embraced.
- ii. Role of OECD evolved is helping members to develop & adopt policy, evaluating its working, understanding the affecting factors & shaping the change for its success.
- iii. Next Stages of working are follow up of 10 years work, recognising change in members perspective about achieving from the policy, evolution of SES, integrating policy in broader governance system for betterment.

Table - 4: Action Plan

Sr. No.	Page & Para No.	Point	Understanding
1	6--1	Title	Action Plan: road map for implementation
2	6--2	Build upon Past work	<ul style="list-style-type: none"> <li>Initial work for specific sectors</li> <li>New shift to holistic approach</li> <li>Responsibility of developing policy shared between national govt. to regional/ local stakeholders</li> </ul>
3	6--3	Build upon Past work	<ul style="list-style-type: none"> <li>Investment approach- assessing cost &amp; outcomes of policy</li> <li>Assessing transformation</li> <li>Identifying new economic drivers &amp; policy approaches</li> <li>Need of flexible policy- can adopt specific needs</li> <li>Promote investment &amp; complementarities among different policies</li> </ul>
4	6--4	Build upon Past work	NRP as a benchmark to assess national rural policies. Countries are slow in adopting NRP

**Observation:**

- In new rural policy a shift is to holistic approach. Policy developing is between national govt. to local stakeholders.
- Investment approach assessing cost & outcomes of policy.
- It has been observed that, NRP is considered as a benchmark to assess national rural policies & countries are slow in adopting NRP.

Table – 5: Action Plan

Sr. No.	Page & Para No.	Point	Understanding
1	7--1	Bold message	Need for Territorial approach but implementation is challenging
2	7--2	Table	<p><b>Objectives</b></p> <ul style="list-style-type: none"> <li>Competitiveness of rural areas</li> <li>Valorisation of local assets</li> <li>Exploitation of unused resources</li> </ul> <p><b>Key target sector-</b> sectors of rural economy</p> <p><b>Main tools -</b> investments</p> <p><b>Key actors -</b> govt from supra national to local &amp; stakeholders</p>

**Observation :** Based on feedback of old paradigm, the changes in objectives, key target sector, main tool & key actors are made in NRP.

Table – 6: Action Plan

Sr. No.	Page & Para No.	Point	Understanding
1	8--1	Title	Appropriate concept & definition of rural
2	8--2	Concept of rural & classification	Old definition of rural & urban based on population density <p><b>Territorial</b> : National → TL2 → TL3 → Local</p> <p><b>classification</b></p> <div style="display: flex; justify-content: space-around;"> <span>Predominantly urban</span> <span>intermediate</span> <span>predominantly rural (26%)</span> </div>

3	8--3	Extended classification	Based on: population density, location of main urban centres & journey-to-work flow. close to cities (80%) & remote(20%)
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**Observation:**

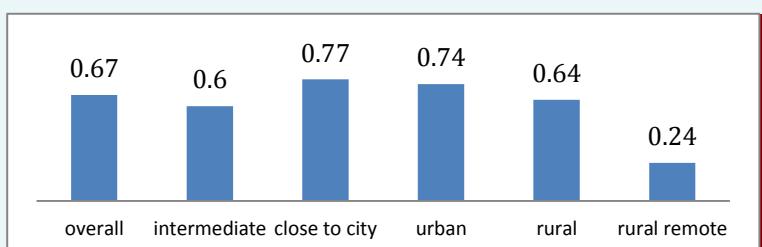
- i. There was a need of defining rural appropriately
- ii. A territorial classification is suggested. About 26% population is occurring in predominantly rural area.
- iii. Extended classification is suggested based on population density, location of main urban centre & journey to work.

**Table – 7: Action Plan**

Sr. No.	Page & Para No.	Point	Understanding
1	9--1	Graph	Nation wise distribution in predominantly rural regions 2012. Ireland has most 75%, Netherlands do not show while OECD(33) have around 25% predominantly rural region
2	10--1	Bold message	About 1/4 <sup>th</sup> of OECD population lives in predominantly rural area

**Observation:** A considerable OECD population lives in predominantly rural area.

**Table – 8: Action Plan**

Sr. No.	Page & Para No.	Point	Understanding																
1	10--2	Close to cities	Rural close to cities catch urban neighbours. remote lost ground																
2	10--3	Annual Growth rate	Annual growth rate in remote rural is 0.24% while their urban counterparts have 0.77%. It helps in understanding the challenges & functioning of different types of low-density economies. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Area</th> <th>Annual growth rate</th> <th>Area</th> <th>Annual growth rate</th> </tr> </thead> <tbody> <tr> <td>Overall</td> <td>0.67</td> <td>urban</td> <td>0.74</td> </tr> <tr> <td>Intermediate</td> <td>0.6</td> <td>rural</td> <td>0.64</td> </tr> <tr> <td>close to cities</td> <td>0.77</td> <td>Rural remote</td> <td>0.24</td> </tr> </tbody> </table> 	Area	Annual growth rate	Area	Annual growth rate	Overall	0.67	urban	0.74	Intermediate	0.6	rural	0.64	close to cities	0.77	Rural remote	0.24
Area	Annual growth rate	Area	Annual growth rate																
Overall	0.67	urban	0.74																
Intermediate	0.6	rural	0.64																
close to cities	0.77	Rural remote	0.24																
3	10--4	classification	Regional accessibility : rural- urban interactions																

**Observation:**

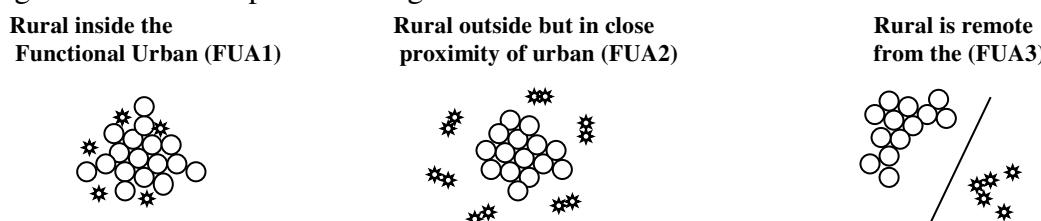
- i. Rural close to cities are coping the pace with urban.
- ii. Annual growth rate of rural close to cities is highest & that of rural remote is lowest.

**Table – 9: Action Plan**

Sr. No.	Page & Para No.	Point	Understanding
1	11--1	Box: definition of rural	Refining the definition of rural. Smallest settlement into the urban category. not found actually.
2	11--2	definition of rural	This mismatching definition created wrong impression- as rural development as a minor issue. A workshop was arranged to correct No one size fits all rural definitions for OECD countries.
3	11--3	Workshop on definition of rural	The key points of workshop: Economic spaces & political accountability, Defining & differentiating rural areas, Recognition of mixed spaces.

**Observation:**

- i. It was difficult to define rural for OECD countries.
- ii. The key points focussed on workshop for defining Rural were,
  - a. Economic spaces & political accountability- Functional definition match with economic realities & administrative definition commits political accountability.
  - b. Defining & differentiating rural areas- characteristics of urban areas & remaining rural.
  - c. Recognition of mixed spaces- Strong urban & rural is better.



**Figure -2: Three types of rural regions**

**Table-10: Challenges facing rural regions**

Sr. No.	Page & Para No.	Point	Understanding
1	12	notes	Challenges facing rural regions (2014)
2	12--1	FUA1	<ul style="list-style-type: none"> <li>a. services delivery as concentrate in the core area</li> <li>b. matching skills according to needs of market</li> <li>c. managing land-use policy</li> </ul>
3	12--2	FUA2	Common in OECD countries. Good industrial mix-local economies more flexible. New residents, economic & social diversity, land scarcity, needs & vision difference.
4	12--3	FUA3	Primary activities- major role in regional economy. Growth-areas of absolute & comparative advantage, connectivity to export markets, matching skills to areas of comparative

		advantage, improving essential services.
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**Observation:**

- i. According to vicinity of rural areas to cities or functional urban areas & commuting patterns, 3 types of rural areas are observed-FUA1, FUA2 & FUA3.
- ii. According to the type, they have different challenges.
- iii. FUA1 has service delivery, matching labour market skills & managing land- use policy as challenges.
- iv. FUA2 has economic flexibility, economic & social diversity, land scarcity, new residents, varied needs & vision as challenges.
- v. FUA3 has primary activities playing major role in local economy, connectivity for exporting; matching skills of comparative advantage & improvement in essential services are the challenges.

**Education** could face these challenges.

**Table – 11: Measures of rural well- being**

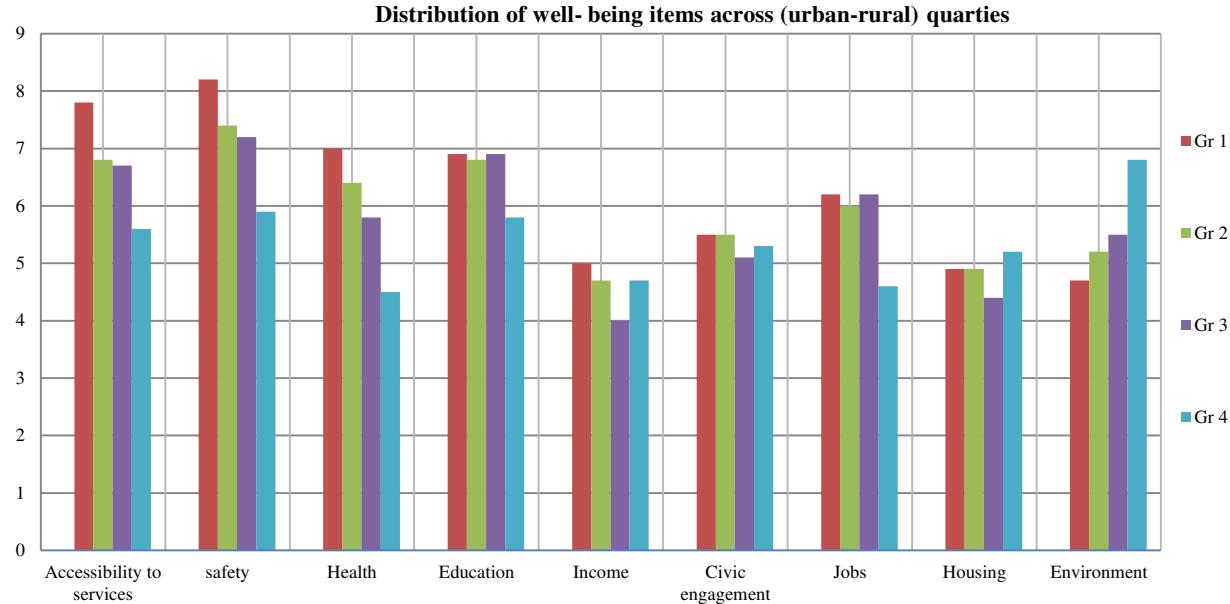
Sr. No.	Page & Para No.	Point	Understanding
1	13	Rural well- being	Rural regions make important contribution to national objectives including economic development & prosperity.
	14--1	Rural challenges	Limited diversification of economic activity, limited accessibility, lack of critical mass, & aging population due to outmigration.
	14--2		Importance of large investments in rural area- Initiative of green economy & renewable energy technology. p15 not related to study
2	16--1	Prosperity	Predominant theme of 10th rural conference : <b>Prosperity</b> ————— Dimension environmental ————— Regional ————— social ————— economical & its dimensions
3	16--2	Message in bold	Policy makers -go beyond own policy sector -promote potential interactions -other policies to capitalize on complementarities suitably.

**Observation:**

- i. Rural regions contribute to national economic development & prosperity.
- ii. Predominant theme of 10th rural conference is Prosperity & metric of which is regional dimension, where do you live. It encompasses the dimensions like - social, economic, environmental & regional.
- iii. Policy makers should go beyond own policy sector to anticipate potential interactions with other policies to capitalize on complementarities suitably.

**Table – 12: Distribution of rural well- being**

Sr. No.	Page & Para No.	Point	Understanding
1	17--1	Figure 6	Distribution of well- being components across urban-rural quartiles



**Figure 3:** Average differences of first 4, accessibility to services, safety, health, education & last environment are statistically significant between group 1& 4.

#### Observation-

- i. Graph shows that, urban dimension is not necessarily associated with higher levels of well-being as rural dweller on environment, housing, with performance measures access to jobs & income in line with cities.
- ii. Average difference of Education indicator is statistically significant between group 1& 4 across urban & rural.

**Table – 13: Implement NRP approach**

Sr. No.	Page & Para No.	Point	Understanding
1	18--1	New approach	Change in priorities- today govt must find new ways to promote broad based economic development in low economic regions.
2	18--2	<b>Bold message</b>	Region specific characteristics should be considered
3	19	<b>policy coordination</b>	OECD (2012a) - need for coordinated sector policies when promoting regional development
4	20	<b>interactions</b>	Promoting functional interactions among policies - adopt a more strategic & inclusive approach. need for institutions that serve as coordination facilitators, promoting exchange of information among different policy makers, in different sectors & govt levels
5	21	<b>Message in bold</b>	Key national policies such as health care, <b>education</b> , innovations & others would benefit significantly from receiving guidance from rural development policy
6	23	<b>Implement NRP</b>	Requires navigating 4 critical steps. 1. Capitalize on opportunities from rural-urban interactions. 2. Enhance rural productivity. 3. Identify & adopt innovative rural service delivery mechanisms. 4. Improve international policy dialogue.

### Observation

- i. New ways to promote broad based economic development in low economic regions should be find out.
- ii. Region specific characteristics should be find out & used.
- iii. Promoting functional interactions among policies - adopt a more strategic & inclusive approach.
- iv. Key national policies such as health care, education, innovations & others would benefit significantly from receiving guidance from rural development policy.
- v. Implementing the NRP requires navigating 4 critical steps.
  - a. Capitalize on opportunities from rural-urban interactions.
  - b. Enhance rural productivity.
  - c. Identify & adopt innovative rural service delivery mechanisms.
  - d. Improve international policy dialogue.

### 7. FINDINGS & CONCLUSION

Above data analysis & interpretation leads to following conclusions. These are the prominent features of the NRP, which fulfils the objective no. 2 of the present study.

- i.) A radical change in NEW RURAL POLICY, 2006 was Investment strategy. Generating economic growth, job opportunities in low density regions was a key priority. In 10th rural conference the direction of future work was decided.
- ii.) Statistical evidence shows that **agriculture is not the main source of income & several rural regions perform in line of urban for economic growth**. It requires large amounts of information & Involvement of sub-central entities. Next Stages of OECD working are follow up of 10 years work, recognising change in members perspective about achieving from the policy, evolution of SES, integrating policy in broader governance system for betterment.
- iii.) Action plan is suggested which describes to build upon past work. NRP assessed national rural policies in 12 countries & found that countries are slow in adopting NRP. Based on feedback of old paradigm, the changes in objectives, key target sector, main tool & key actors are made in NRP.
- iv.) There was a need of defining rural appropriately. A considerable OECD population (25%) lives in predominantly rural area. Annual growth rate of rural close to cities is highest & that of rural remote is lowest. According to vicinity of rural areas to cities or functional urban areas & commuting patterns, 3 types of rural areas are observed-FUA1, FUA2 & FUA3. According to the type, they have different challenges.
- v.) Predominant theme of 10th rural conference is Prosperity & it is measured through 9 components of well-being. Policy makers should go beyond own policy sector to anticipate potential interactions with other policies to capitalize on complementarities suitably.
- vi.) Distribution of rural well-being indicators shows that both urban & rural groups are at higher, lower or at same levels for different indicators. Average difference of

**Education** indicator is statistically significant between group 1& 4 across urban & rural.

- vii.) Key national policies such as health care, **education**, innovations & others would benefit significantly from receiving guidance from rural development policy. Implementing the NRP requires navigating 4 critical steps.
- a. Capitalize on opportunities from rural-urban interactions.
  - b. Enhance rural productivity.
  - c. Identify & adopt innovative rural service delivery mechanisms.
  - d. Improve international policy dialogue.

## 8. EDUCATIONAL SIGNIFICANCE OF NRP

### I. SIMILARITIES BETWEEN NRP & RUSA

It is rightly & repeatedly stated in NRP that, Key national policies such as health care, **education**, innovations & others would benefit significantly from receiving guidance from rural development policy. Policy on higher education in India namely National Higher Education Mission with its trivial name, Rashtriya Uchchatar Shiksha Abhiyan (RUSA) has similarities with NRP in using holistic approach, investment approach & inclusive approach for development. A strategic use of funds is recommended in both the policies. As a regional dimension is found in NRP, autonomy is there in RUSA. Both documents insist for economic growth & employment.

### II. EDUCATIONAL APPLICATION

- i. Statistical evidence, **agriculture is not the main source of income & several rural regions perform in line of urban for economic growth** is very useful for depressing farmers in India, particularly from Maharashtra state. Along with agriculture as a source of income, farmers should be mastered with employable skills. Urban- rural interactions should be improved. Educational curriculums can include field visits, excursions, internships apprenticeships, surveys, projects those would be complementary to urban & rural learners for their interactions.
- ii. India has started so many schemes for rural development & many of them are successful. But if still the problem persists, gaps should be find out by which farmers get depressed. Rural schemes & programs should be assessed through process evaluation to find out the gaps.
- iii. Defining 'Rural' is essential for all sectors policy makers.
- iv. **Learners from predominantly rural area-** Distance learning or delivered through e-learning related to employable skills would be useful based on local needs. Periodical follow up would be helpful to improve quality.
- v. **Rural Learners close to cities** - As annual growth rate is found to be highest for rural close to cities, education should provide opportunities to increase the interactions between rural & urban learners.
- vi. **Functional Urban Areas** -Figure 2 is useful for educational field, which states about not only the skill based education but type of skills useful for urban & rural part with economic significance.

- a. For FUA1 service delivery skills, area specific & need based labour market skills could be incorporated in curriculum.
  - b. For FUA2 transferable skills along with core skills would be useful for more resilient local economies. Social skills to overcome social & economic diversity.
  - c. For FUA3 skills related to primary activities, essential service delivery skills would be useful.
- vii. **Large Investments in rural part-** Initiative of green economy & renewable energy technology should be incorporated in curriculum.
- viii. **Prosperity-** Education can train both urban & rural learners to nullify the significant difference between the levels of the well-being components across 4 groups. It would be achieved by Skill development through Health education, Education for safety, Education for accessibility & Environment education.
- In short & broadly this way education sector can anticipate potential interactions with rural development policy to capitalize on complementarities during its policy implementation at higher education level.

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# Optimization Of Explosives For Demolition Of Structure Using Finite Element Analysis And Sequencing Of Operation

Paper ID	IJIFR/V3/ E11/ 019	Page No.	4056-4077	Subject Area	Civil Engineering
KeyWords	Demolition, Dipiladated Structure, Explosives, ANSYS, FEA				

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## Abstract

Civil structures in the city that have been invalidated with the expiry of its useful life need to be demolished in a timely and controlled manner. The subject matter of this work is the realization of this objective through planning, evaluation and recommendation of a suitable course of action for the project at hand. In particular, evaluation phase shall be the focus of the work which in turn, is proposed to be taken up using Analytical techniques for identifying the significant parameters affecting the given problem. The same shall be pursued to find optimal set-points using Computational Techniques like the use of FEA software, ANSYS is proposed as a solver to find solution towards the optimal levels of explosives to be used and location for placing the same within the structure. The explosives are required to exceed the instantaneous compressive strength of the material in its immediate vicinity. The stress plot determined by the computational analysis shall be referred to make inference of the performance. Safety aspects shall be identified and documented.

## 1. INTRODUCTION

The term “Demolition” implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or as shown on the drawings.



Demolition of any structure is the process of destroying down or falling down or collapsing down of large buildings after its useful life period with the help of some equipment or other method with a legal procedure followed by the consent of the local authority. When demolition occurs, it is usually a sign of coming growth, expansion, or renewal. Major cities in the United States and elsewhere are constantly renewed. Old factories are gutted and converted into new office spaces or residences. Industrial facilities are cleared to accommodate new machinery and equipment. Dilapidated housing is demolished to make way for new and more efficient residential uses.

Any demolition activity to start with, there are many steps that need to take place forehand including but not restricted to performing asbestos abatement, removing hazardous or regulated materials, obtaining necessary permits from the authority, submitting necessary notifications, disconnecting utilities, and development of site-specific safety and work plans for the workers as well as the surroundings with a detail planning of every stage with a working strategy. A demolition review ordinance should spell out specific criteria for determining which properties are subject to review.

Most communities require some level of review for all buildings or structures at least fifty years old, but others have restricted review to those at least one hundred years old. Other communities have applied demolition review to properties previously identified through a historic resources surveyor listed on the State or National Register of Historic Places. Finally, some communities decide to apply protection to a specific geographic area, such as a downtown or Main Street. In most cases, the historic resources survey or tax assessment records can verify the age of a building proposed for demolition. If no survey information exists, the burden of establishing the date of construction can rest on the applicant or can be left to the review body. Once a building or structure has been determined to meet the age or geographic criteria, the review body— often with the assistance of municipal staff – typically determines whether it is significant. Significance can be determined by analyzing the building's association with historic persons or events, or with the architectural, cultural, economic, or social history of the community. The review process works best when a historic resources survey exists to verify a building's age, as well as its architectural and historical significance, or where there is properly trained municipal staff to assist with the necessary research. In both Keene and on cord, for example, the demolition review committee, which is comprised of three members of the Heritage Commission, is responsible for conducting the initial review, making the official determination of significance, and holding the meeting to explore alternatives.

Demolition review is a preservation tool that ensures potentially significant buildings and structures are not demolished without notice to the community and review bylaw heritage or historic district commission. A demolition delay ordinance can be adopted as an amendment to the building code, implemented as a stand-alone ordinance, or as a bylaw in an existing historic preservation or zoning ordinance. This legislation can be a very effective tool in helping to protect historically significant resources in the community.

Buildings when demolished with the help of explosions are called as an implosion a systematic technique of bringing down the structure. Demolition blasters load explosives on several different levels of the building so that the building structure falls down on itself at multiple points. When everything is planned and executed correctly, the total damage of the explosives and falling building material is sufficient to collapse the structure entirely, so clean-up crews are left with only a pile of rubble. Now day-by-day increasing population in the world results to increase in the needs for desire of human beings. And that are going to results in creating the waste from all the sectors or in all the ways.

An implosion is an event where something collapses inward, because the external atmospheric pressure is greater than the internal pressure. For example, if you pumped the air out of a glass tube, it might implode. When a building is surrounded by other buildings, it may be necessary to "implode" the building, that is, make it collapse down into its footprint. You can demolish a stone wall with a sledgehammer, and it's fairly easy to level a five-story building using excavators and wrecking balls. But when you need to bring down a massive structure, say a 20-story skyscraper you have to haul out the big guns. Explosive demolition is the preferred method for safely and efficiently demolishing larger structures. The basic idea of explosive demolition is quite simple: If you remove the support structure of a building at a certain point, the section of the building above that point will fall down on the part of the building below that point. If this upper section is heavy enough, it will collide with the lower part with sufficient force to cause significant damage. The explosives are just the trigger for the demolition. It's gravity that brings the building down.

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## 2. LITERATURE REVIEW

The author [1] presents the Adaptively Shifted Integration (ASI) technique, which produces the highest computational efficiency in the finite element analyses of framed structures including static and dynamic collapse problems, are applied to the explosive demolition analysis and the seismic damage analysis of a reinforced concrete building. By expressing an explosion or a member fracture by a plastic hinge located at the exact position with a simultaneous release of resultant forces in the element, discontinuous problems such as these dynamic collapse problems can be easily analyzed even by the conventional finite element code with the displacement form. By using the algorithms described in this paper, sufficiently reliable solutions for the practical use have been obtained in the explosive demolition and seismic damage analyses of a five stories-five span reinforced concrete building. This present technique can be easily implemented with a minimum effort into the existing finite element codes utilizing the linear Timoshenko

beam element. By expressing an explosion or a member fracture by a plastic hinge located at the exact position with a simultaneous release of resultant forces in the element, discontinuous problems such as these dynamic collapse problems can be easily analyzed. In this technique the numerical integration points in an elastically deformed element are placed at the optimal points for linear analysis while the integration points are shifted immediately after the occurrence of fully plastic section in the element, using the reactions between the locations of numerical integration points and those of plastic hinges to form a plastic hinge to form a plastic hinge at the position of that section. Thus technique produces higher computational accuracy with fewer elements than the conventional method. An explosion or a member can be expressed by plastic hinge located at the exact position with simultaneous release of resultant forces in the elements, which produces the dynamic collapse of building with this proposed technique, discontinuous problems can be easily analyzed.

In this paper author [2] identifying the need for demolition technique and design safe and efficient deconstruction procedures. According to author in Germany there are about one million unoccupied apartments – most of them in precast concrete panel buildings. Although large sums of money have been expended on retrofitting these houses, German ministry of construction recommended demolition of as many as 350 thousands of apartments for which retrofitting is not feasible. Expected costs of the demolition run at \_ 350 million, with some experts putting the figure even ten-times higher. To reduce these costs, new deconstruction methods are being developed. Due to their cost and time efficiency, demolition methods employing controlled explosions receive much attention. In order to safely and successfully perform the demolition, it is essential that appropriate sizes, placement and timing of charges are determined. In order to facilitate a conscious design of safe and efficient deconstruction procedures, a methodology for FEM-based simulation of collapsing precast concrete buildings has been proposed recently.

In a contrast to the standard structural analysis, when we want to simulate building demolition, the main interest is prediction of mechanical behaviour of the structure during the phase when it disintegrates and loses static stability. The mechanical phenomena to be dealt with include material fracturing and yielding on one hand, and dynamic motion (finite displacements and rotations) and interaction of debris on the other. Since even separate numerical analysis of each of these phenomena presents a complicated task, when we have to consider them simultaneously, a suitable computational strategy has to be employed. A typical precast concrete building consists of relatively stiff reinforced concrete members (panels), which are interconnected by rather weak joints. Structural failure in such a system usually occurs at or in the vicinity of the joints. The failure usually has a localized character and involves cracking and crushing of concrete and yielding and rupture of steel reinforcement. A detailed simulation of these phenomena generally requires two- or three-dimensional FE analysis with solid elements and nonlinear material models. Despite ever-increasing computational power, such an analysis is feasible at the level of an individual structural element, but performing this way a



geometrically nonlinear transient-dynamic analysis of an entire building would be too costly. On the contrary, the latter can be efficiently analyzed using beam or plate elements. Thus, we model the whole structure as an assembly of deformable beam elements interconnected by fracturing joints

In this paper the author [3] identifies the problem faced in demolition of industrial building. To analyse the behaviour of the structure in question at the demolition by blasting, he have used The Applied Element Method, combining features of finite element method with discrete element method. The time for the complete analysis is reasonable and the accuracy of the results is satisfactory. In the paper he is present a way of checking and optimization of a demolition scenario at an industrial building based on controlled blasting method in order to transition to the actual demolition of the building in question. For this purpose he used a specialized computer system that describes the behaviour of the structure at exceptional actions, from the application of forces, the opening and propagation of cracks, the separation structural elements up to total collapse of the building. According to author simulation results validates the demolition scenario and the blasting parameters of the building. This analyse can also constitute the basis for effective achieve of this demolition. The demolition analysis, showed that the structure collapsed in the desired direction and after impact with the ground was compact broken without it result the projections with long-range which to endanger nearby dwellings.

The author [4] present optimization of blasting optimization of blasting strategies for the safe and economic demolition of large scale buildings by means of controlled explosives. Building blocks of the presented approach are i) an efficient multi-level simulation model for the collapse of the building, ii) appropriate optimization models and evolution strategies as optimization methods and iii) modern computer methods for the implementation of distributed software system for the planning of complex blasting projects. In the case of high rise structures and huge building complexes the demolition by means of controlled explosives has proven to be an efficient technology. The main advantage over conventional demolition techniques applying special machinery is the fact that the cost intensive application of men and machinery is primarily limited to the drilling of holes and loading them with the explosive charges in destined zones of the building. The main idea of virtually every blasting strategy is to eliminate vertical supports of the structure by the controlled explosions and to leave the rest of the work to gravity.

According to author in the planning stage, the engineer has to decide on the number and placement of the explosive charges and the time flow of the ignition. However, accidental blasting projects show that this traditional, empirical approach is error prone because it is a difficult task to determine the optimal amount and position of the charger zones and the sequence of ignition in order to have a efficient and safe demolition. This problem is addressed by different investigations on the numerical simulations of demolition processes by means of controlled explosives. A computer system for the planning of the demolition of chimneys by felling them into a predetermined fall plane has been developed. Researchers at the University of Tokyo have developed a lumped mass model based



method for the simulation of collapses due to earthquakes that is also applicable to the simulation of demolitions by means of explosive charges. Other approaches like use the finite element method with special extensions to the numerical simulation of collapses. The realistic and efficient simulation of a demolition of a structure by means of controlled explosives requires a powerful simulation model that covers the entire complex dynamic process that is evoked by the ignition of the loads and ends with the collapse of the building. The concept of the developed simulation model is therefore based on a multi-level model of the blasting process that comprises three main levels: On the first level (local level) the effects of the exploding charges are modelled such that the volitional damages can be captured and described. On the second level (near field level) the effects of the local damages on the adjacent structure are analyzed. Based on the first and second level, finally the collapse of the entire structure is modelled on the third level (global level) including fracture processes and relevant contact mechanisms.

The author [5] says that demolition of building at the end of their life become more and more important. These building have either no longer attractive in architectural sense or did not match required standard. To avoid damage of neighbouring building or traffic facilities an accurate prediction of building collapse is needed. Otherwise uncontrolled collapse may cause great physical major collateral damage may. Using Finite Element Analysis model we controlled the unwanted collapse of building and save time and cost. The main advantage over conventional demolition techniques applying special machinery is the fact that the cost intensive application of men and machinery is primarily limited to the drilling of holes and loading them with the explosive charges in destined zones of the building. In this paper author uses finite element model to investigate the collapse. In this he proves that quality of prediction has been carried out. Author focus on influence of failure criterion to the prognosis quality.

The main problem of a demolition from the viewpoint of the engineer is that the dynamic structural behavior of the building during the collapse is not known. To give the engineer a tool for this prediction and to estimate the risk of a blast strategy the research unit 500 built up an analysis concept which investigates the important influences of the demolition by using explosives. The main goals are to produce a good a "priori" prognosis of the collapse belonging to a chosen blast strategy, as well as to consider uncertainties in geometrical and material data and to produce a computational tool for the practice. The concept considers different spatial levels and, as mentioned before, the uncertainties. Also, the verification and especially the validation of the results are important for the numerical analysis and are parts of the concept. The research unit is divided in four subprojects. Main goal of the project is an object oriented software system for the multi-level simulation and optimization of the demolition process by controlled explosives of reinforced concrete structures.

The goal of the investigations is to generate specific information about the collapse kinematics of buildings demolished by blasting. In this contribution a validation process is performed for an example of a reinforced concrete industrial structure with a toppling



collapse sequence after the controlled blasting. Two model approaches are investigated which take into account the failure, especially the separation of structural parts. The approach without an erosion of the highly reinforced parts of the structure shows the best agreement with the validation data.

One of the main hypotheses which were proven by many video sequences of real world collapse of reinforced concrete structures is the appearance of local zones of high damages. These zones work in a mechanical sense like hinges in the region of large deformation and can split up in a final stage of loading. Therefore the computational models must have the ability to reproduce these phenomena in the numerical analysis process. In this contribution the focus is laid on investigating the influence of the failure criterion to the prognosis quality by using element erosion. Further investigations should be done with different kinds of modeling failure, e.g. opening the connection of the elements at the nodes. This procedure has not the defect of losing mass and volume during the separation process. Another important point is the description of the failure criterion, especially the definition of separation, for reinforced concrete structures with coarse meshes.

### 3. PROPOSED APPROACH

Blasters approach each project a little differently, but the basic idea is to think of the building as a collection of separate towers. The blasters set the explosives so that each "tower" falls toward the center of the building, in roughly the same way that they would set the explosives to topple a single structure to the side. When the explosives are detonated in the right order, the toppling towers crash against each other, and all of the rubble collects at the center of the building. Another option is to detonate the columns at the center of the building before the other columns so that the building's sides fall inward

According to Brent Blanchard, an implosion expert with the demolition-consulting firm Protect documentation services virtually every building in the world is unique. And for any given building, there are many numbers of ways a blasting crew might bring it down. Blanchard notes the demolition of the Hayes Homes, a 10-building housing project in Newark, New Jersey, which was demolished in three separate phases over the course of three years. "A different blasting firm performed each phase," Blanchard says, "and although all of the buildings were identical, each blaster chose a slightly different type of explosive and loaded varying numbers of support columns. They even brought the buildings down in different mathematical sequences, with varying amounts of time factored in between each building's collapse."

Generally speaking, blasters will explode the major support columns on the lower floors first and then a few upper stories. In a 20-story building, for example, the blasters might blow the columns on the first and second floor, as well as the 12th and 15th floors. In most cases, blowing the support structures on the lower floors is sufficient for collapsing the building, but loading columns on upper floors helps break the building material into smaller pieces as it falls. This makes for easier clean-up following the blast.

Once the blasters have figured out how to set up an implosion, it's time to prepare the building. In the next section, we'll find out what's involved in pre-detonation prepping and see how blasters rig the explosives for a precisely timed demolition.

An structure which is made by any material is to be demolished after it's designed age is completed in order to reutilized the valuable land. Demolition was also necessary to remove danger of falling. In western railway, Mumbai division, there was a G+3 storied building numbered as 25/T. It was built in 1924, constructed by BB & CI railway as a first cement concrete residential structure in Mumbai. It was having 80 Nos. (4×20) type I Quarter with total land area about 430 Sq. m. The total height was 13.20 m. above rail level. The structure completed its designed life and existing condition of building was so deteriorated that there was no option but to demolition the same for safety of running trains and adjoining residents.

### **Drilling of holes for placement of explosive**

The holes were drilled of about 25 mm to 30 mm dia and about 20 to 30 cm deep depending upon quantity of explosive energy is required to break a particular support. In this case the building was planned to bring down on its footprint. We provided 20 holes of 25mm dia & 30 cm in depth central column .It was reduced to 4 holes of 25mm dia & 20cm deep (4x1) at columns away from centre.

### **Quantity of Explosive**

The quantity of explosive to be placed depends upon the size of column and extent up to which it is to be destroyed. Depending on above requirements we placed 250 gm of explosive in central 24 columns. & 125 gm in outer 16 columns, because it was desired to destroy the central column completely. No outer column was weakened so that the building collapsed towards its centre from both side.

### **Type of explosive and detonator**

There are two types of explosive commonly used for implosion RDX & gelatin. In this case we used brand name 'Power Gel ' explosive, which is, ammonium nitrate based explosive which expand at very high speed and applies at a very high pressure of about 600 T/sq inch. The electronic detonators were used to ignite the explosive.

### **Ballasting**

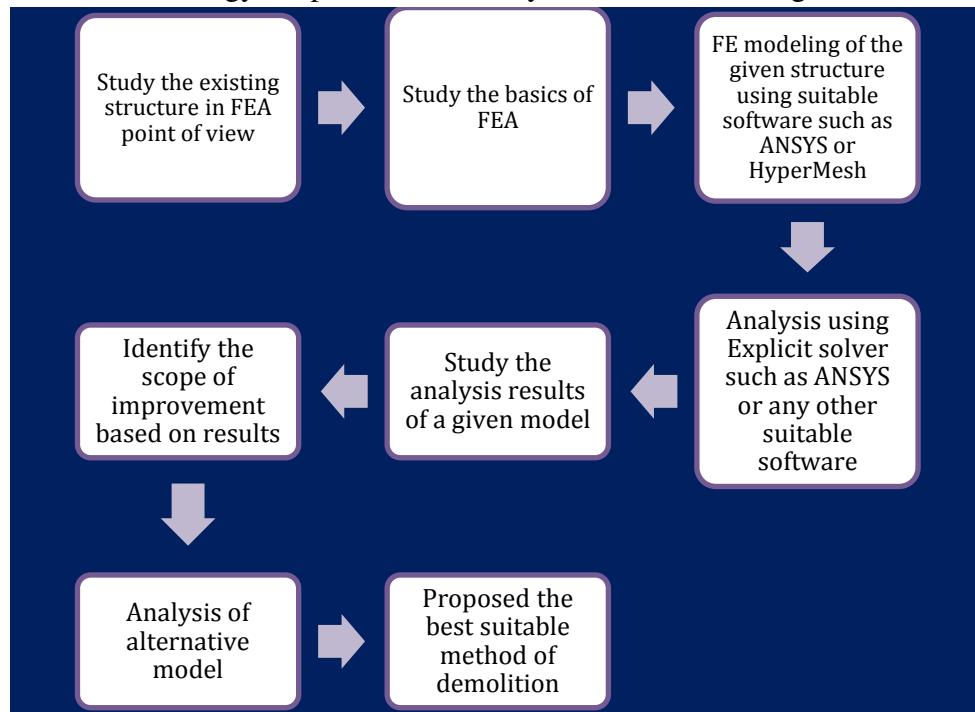
Ballasting of Charges / Explosives work are carried out in a controlled manner such that there will be a time gap of 1/100 second between two successive blasts. The trigger of charges is done in such a control manner so that the noise pollution and air pollution should be minimum. The central column is first triggered and then blast proceed towards outside to produce three way action and hence results the fall of existing structure on its footprint.

### **Falling of structure**

Once central support/column will be destroyed and adjoining columns will be weakened, due to its gravity the entire mass will come down on its footprints. In this case after blasting within few seconds the entire structure of (g+3) storied came down on its footprint without damaging any adjoining asset.

#### 4. RESEARCH METHODOLOGY

The research methodology adopted for this study consist of following,



**Figure 1: Flow diagram of methodology**

Computational methodology shall be deployed using FEA software for identifying the alternatives for the significant parameters influencing implosion. ANSYS software is identified as a suitable solver for conducting this exercise using virtual simulation. ANSYS simulation software gives designers the ability to assess the influence of this range of variables in a virtual environment. Thus, engineers can advance through the design and materials selection process quickly and efficiently. ANSYS tools guide the user through coupled rock and soil mechanics analysis; material-specific maximum load assumptions; linear, nonlinear, static and dynamic analyses; sensitivity and parametric studies; and other related work — which together provide significant insight into design behavior that would be difficult with single analysis runs. Through visualizing the effect of a wide range of variables, engineers can narrow the scope of field investigations, save considerable time and cost on projects, and move more quickly to the ground-breaking stage. The advanced capabilities of ANSYS software create a powerful tool for civil engineering projects as diverse as high-rise buildings, bridges, dams, tunnels and stadiums. By testing materials and experimenting with design in a virtual environment, engineers and designers can analyze safety, strength, comfort and environmental considerations. The result is cost-effective and innovative design.

In a contrast to the standard structural analysis, when we want to simulate building demolition, the main interest is prediction of mechanical behavior of the structure during the phase when it disintegrates and loses static stability. The mechanical phenomena to be



dealt with include material fracturing and yielding on one hand, and dynamic motion (finite displacements and rotations) and interaction of debris on the other. Since even separate numerical analysis of each of these phenomena presents a complicated task, when we have to consider them simultaneously, a suitable computational strategy has to be employed.

## 5. OBJECTIVES OF PROPOSED WORK

The objectives of the work are as follows:

- Evaluate and identify demolition options for multi-storeyed building.
- To study the suitability of an implosion technology for demolition of building through literature review
- To deploy computational techniques for determining alternatives for the parameters applicable to implosion (e.g. - Type of explosive, Amount of explosive, Placement of the explosive within the structure to be demolished).
- To optimize the solution through comparison of the alternatives analyzed
- Recommend the solution upon review.

## 6. CASE STUDY AND ANALYSIS

Following are details of case study

Type of structure ----- R.C.C. framed structure.

- 1) Height of structure ----- G+5 story
- 2) Area of plot ----- 1634.64 m<sup>2</sup>
- 3) Area of structure ----- 1230.62 m<sup>2</sup>
- 4) Volume of Structure ----- 82.992 m<sup>3</sup>
- 5) Mass of structure ----- 192541.44 kg
- 6) Density ----- 2320 kg/m<sup>3</sup>

### Things to do before Demolition Begin

Explore asset and resource recovery of items normally left for demolition disposal. Prepare a clear and complete scope of work and discuss it in detail with the demolition contractor prior to starting work. Ensure that you receive guaranteed legal disposal of all demolition materials. Mark, cut and cap all utilities and communication lines to demolition area this action can result in double savings by reducing the cost of demolition service and bringing in cash for salvaged items. There are many companies that will pay you to remove your unwanted items but who don't do demolition work. This is an excellent way to productively fill a ten-day waiting period in total or structural demolition. Coordination and communication between your demolition contractor and with his on-site supervisor is critical. We recommend that a final review of the project plan be completed on the first day of the job. Demand that your demolition contractor work in coordination with local landfills or recycling centers to dispose of onsite materials properly. Verify that your contractor complies with mandated resource recovery provisions for disposed project materials.

Table 1: Sequence of Demolition Activity

Demolition Activity Sequence	General Description
Disconnection of services	Shutoff of Electricity, Gas, water etc
Inventory of Hazardous wastes	e.g. Asbestos etc.
Removal of Abandoned Furniture/Equipment	e.g. Furniture/white Goods
Removal of Asbestos/Hazardous Materials	e.g. Application of H&S Procedures
Removal of Fixtures	e.g. Fitted Presses etc.
Removal of Timber	e.g. Removal of Floors, Trusses, Rafters
Demolition of structure shell	Manual or Mechanical Demolition
Source segregation of Material Fractions	Separation into Designated Material Fractions
Transport of Material from site to Treatment Facilities	e.g. C&D waste Recycling Facility
Transport of Material from site to controlled disposal sites	e.g. Intertied Hazardous Landfill site
Site preparation/Restoration	e.g. Hard standing, Landscaping

## PROCEDURE FOR DEMOLITION AND REMOVAL OF BUILDINGS

### i. INSPECTION DEPARTMENT

**734-466-2580**

- 1) Demolition Permit application must be completed and filed with this office. No accessory buildings may be left on the property without an approval from the Zoning Board of Appeals.
- 2) With the application, **submit** written releases from Detroit Edison, Consumers Power, the Telephone Company, the Cable Company and the City Water Department.
- 3) A Plumbing Permit for inspection of cap-off water and sewer, or inspection of wells, septic tanks or cisterns are required.

Minimum Plumbing Permit fee is charged. (Note: a licensed plumber is not required for purpose of this permit). All building demolition fees are based upon cubic feet.

### ii. RELEASES AND INSPECTION

Note: Following are requirements for abandoning sewer and water facilities:

- a) Contact Miss Dig and then the City Inspection Dept. (Plumbing) 734-466-2580 to arrange for inspection of the work as it is being completed. Note: The sewer and water services are to be abandoned properly **prior** to the building demolition.
- b) Sewer leads shall be disconnected and capped at the property line and left open for inspection by the Plumbing Inspector.
- c) Water service shall be disconnected on the building side of the stop box, crimped and left open for inspection by the Water Department (for the location of the stop box and inspection of the disconnect, please call 734-466-2633).
- d) Existing septic tanks and cisterns must be disconnected, pumped, crushed and filled with sand. A Well Permit from the States required abandoning any wells. (Done by a licensed well driller)

### iii. INSPECTION

An **open hole** in section from the Inspection Department is required 734-466-2580. The permit holder shall notify the Inspection Department 734-466-2580 to schedule a final inspection when the demolition has been completed, the debris removed and the property has been graded and filled to established street grades.

**iv. DEPARTMENT OF PUBLIC WORKS – ENGINEERING DIVISION  
734-466-2571**

A Demolition Permit for work in the City right-of-way is required from this office. A minimum 35,000 cash deposit (refundable) as well as a 1,000 processing fee is required for the abandonment of utilities, grading or other operations in the public right-of-way.

**v. IN THE RIGHT-OF-WAY:**

Any sidewalk damaged as a result of the demolition process will be replaced at permit holder's expense. Existing sidewalks in the right-of-way cannot be removed without written consent of the Engineering Division.

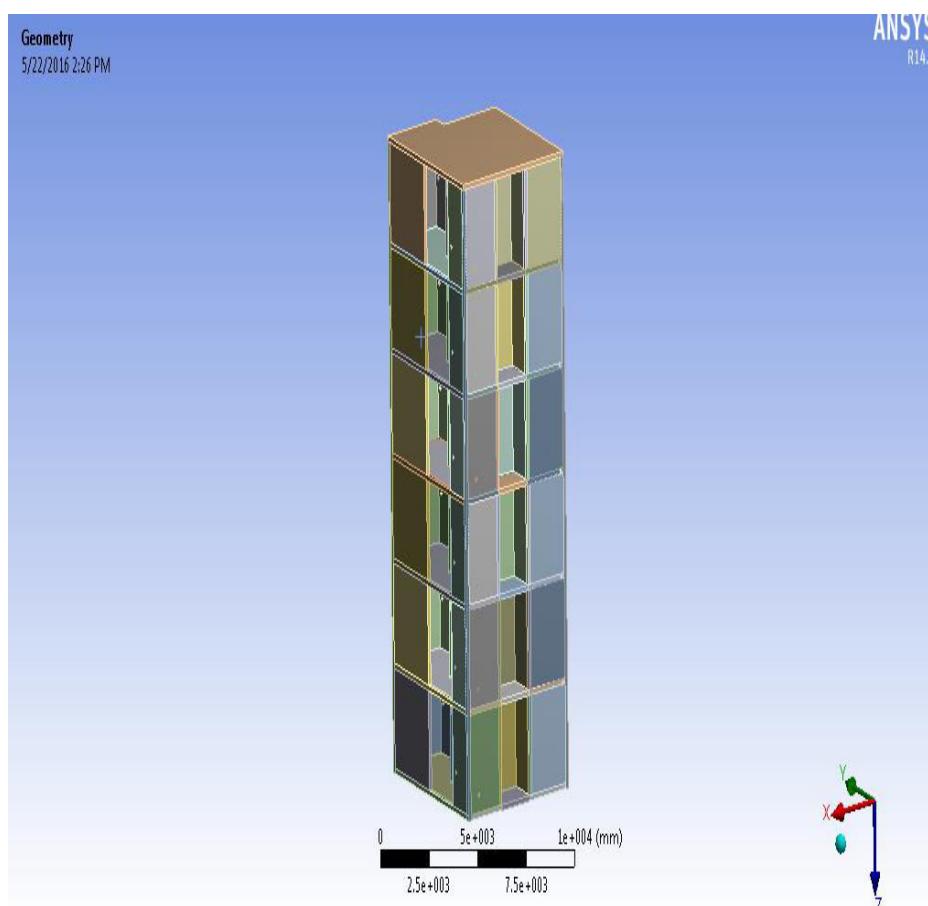
**vi. SOIL EROSION**

A soil erosion permit may be required, please check with the Engineering Division at 734-466-2571.

**vii. FINAL INSPECTION**

The permit holder shall notify the Engineering Division 734-466-2571 when the demolition has been completed. Upon release of the Building Department Permit and satisfactory restoration of the street right-of-way or easement area, the cash deposit will be returned to the permit holder. Further, the entire site will have to be top soiled and seeded with vegetative growth, if a new permit to put a new structure has not been obtained.

In this project I am using Ansys and FEA software draft out building and for finding different loads and stress involved in building for drilling size of hole and placement of explosive in dill to demolition of building.



**Figure 2: Geometry of building**

Table 2: Material properties (concrete 35 MPa)

Properties of Outline Row 3: CONC-35MPA			
	A	B	C
1	Property	Value	Unit
2	Density	2314	kg m <sup>-3</sup>
3	Specific Heat	654	J kg <sup>-1</sup> C <sup>-1</sup>
4	RHT Concrete Strength		
5	Use cap on Elastic Surface	Yes	
6	Compressive Strength fc	3.5E+07	Pa
7	Tensile Strength ft/fc	0.1	
8	Shear Strength fs/fc	0.18	
9	Intact Failure Surface Constant A	1.6	
10	Intact Failure Surface Exponent n	0.61	
11	Tension/Compression Meridian Ratio Q2.0	0.6805	
12	Brittle to Ductile Transition BQ	0.0105	
13	Hardening Slope	2	
14	Elastic Strength/ft	0.7	
15	Elastic Strength/fc	0.53	
16	Fracture Strength Constant B	1.6	
17	Fracture Strength Exponent m	0.61	
18	Compressive Strain Rate Exponent a	0.032	
19	Tensile Strain Rate Exponent δ	0.036	
20	Maximum Fracture Strength Ratio SFMAX	1E+20	
21	Damage Constant D1	0.04	
22	Damage Constant D2	1	
23	Minimum Strain to Failure	0.01	
24	Residual Shear Modulus Fraction	0.13	
25	Bulk Modulus	3.527E+10	Pa
26	Shear Modulus	1.67E+10	Pa

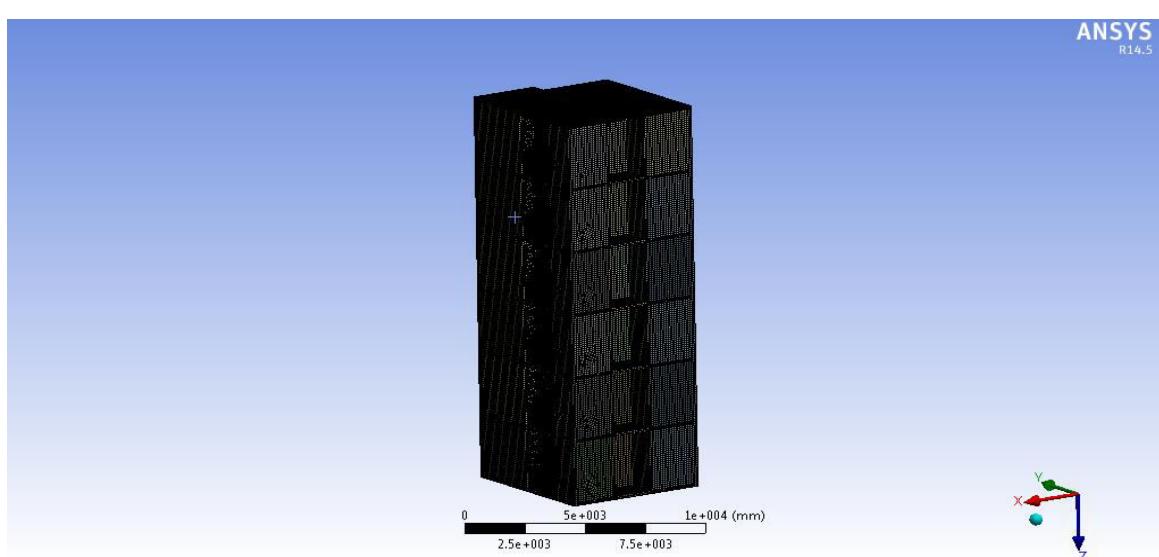


Figure 3: Meshed Model

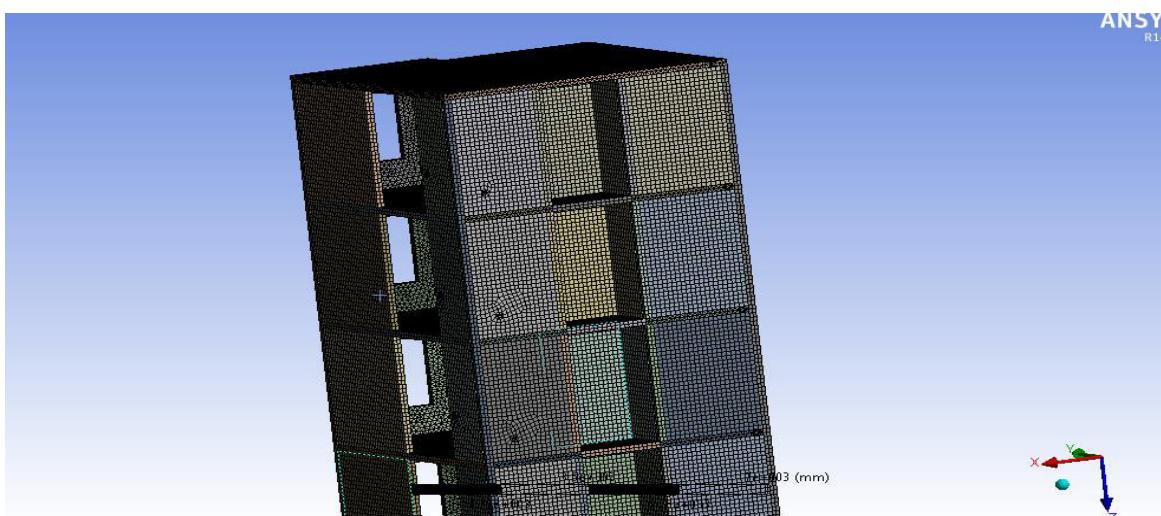


Figure 4: Shape of element: - hexagonal

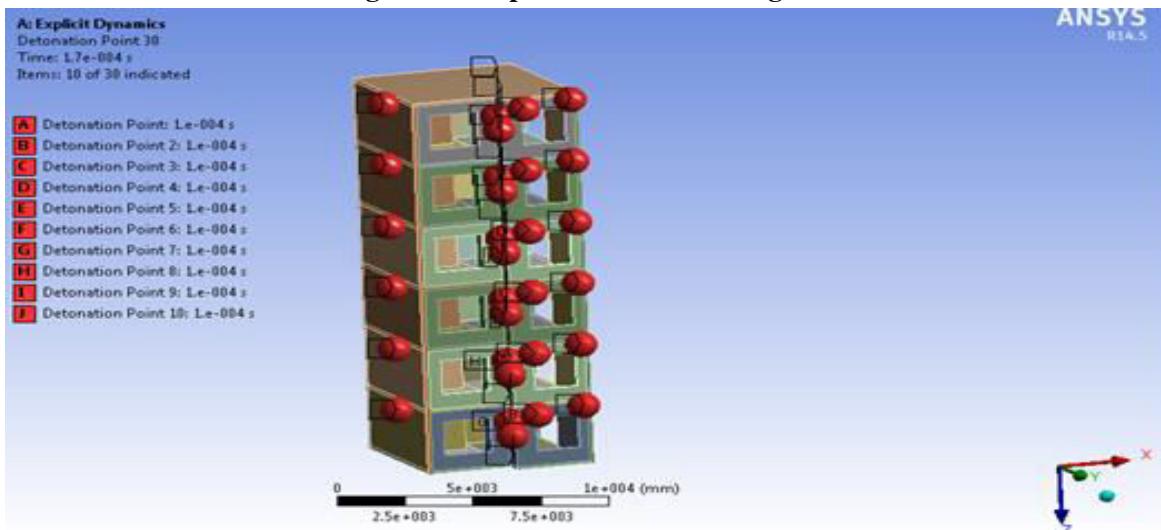


Figure 5: Boundary Conditions

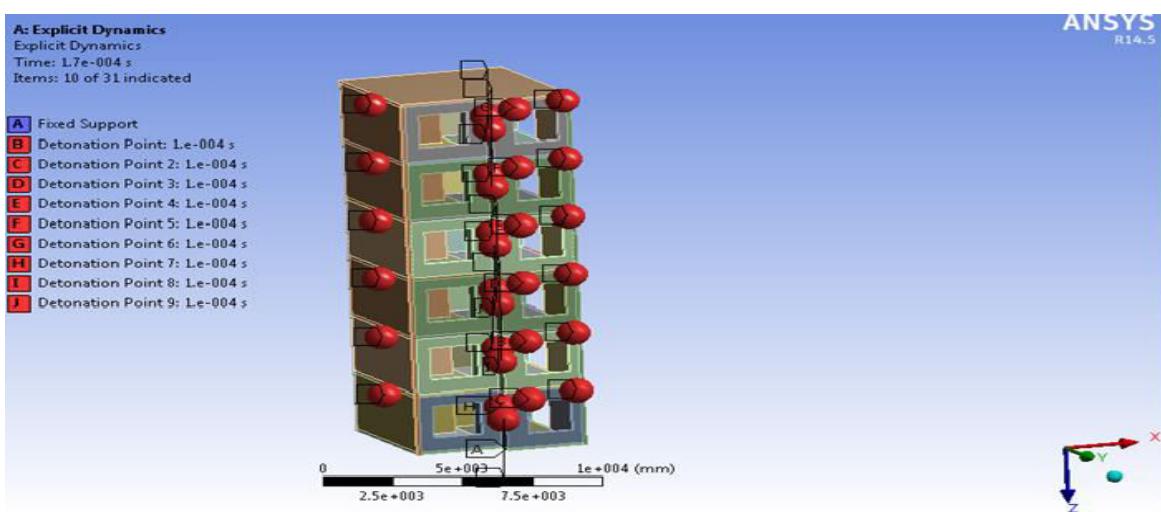
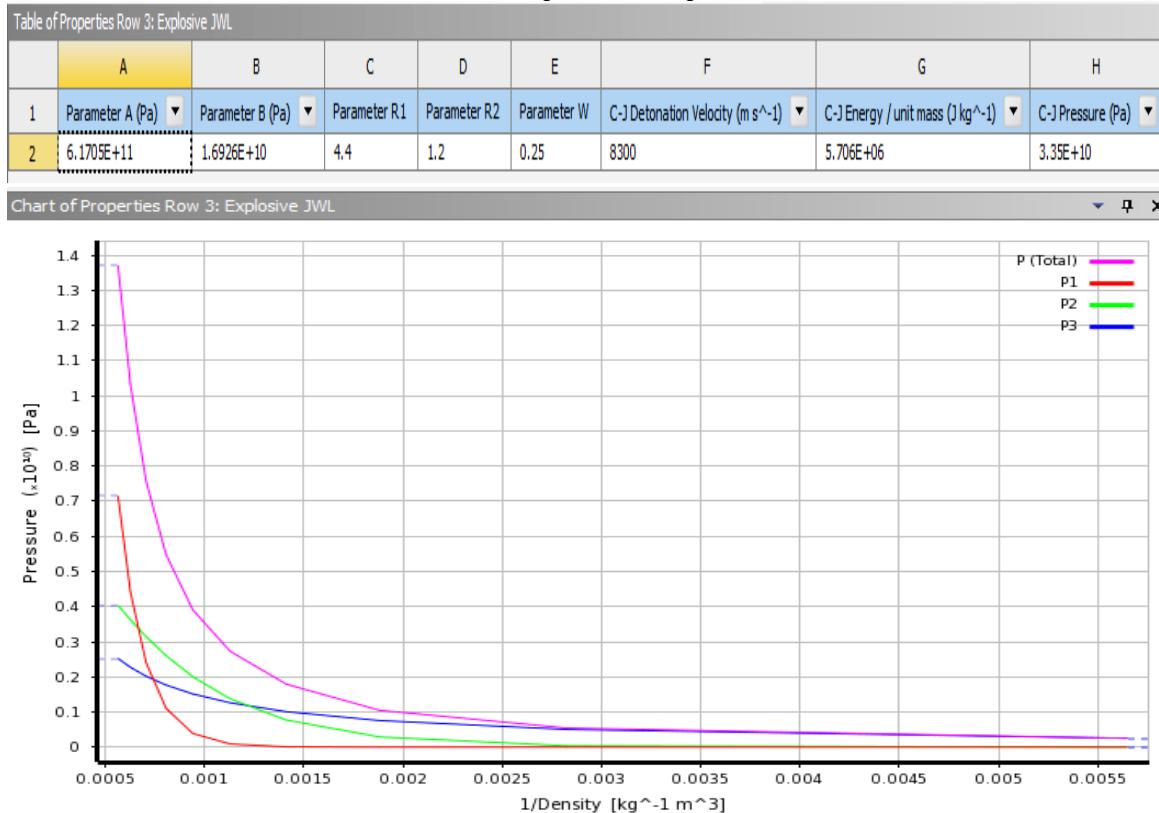
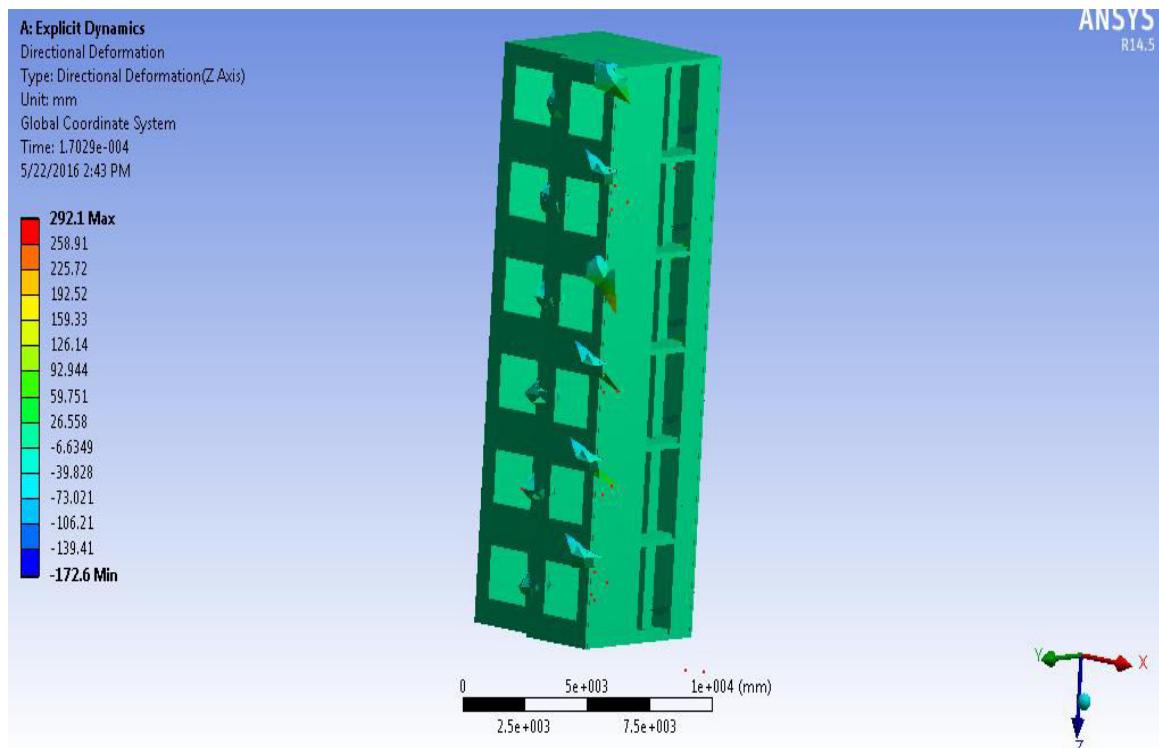


Figure 6: Closed view of Boundary Conditions

**Table 3 :. Material Properties of Explosive PETN 1.77**



**Figure 7: Graph of material properties of explosive PETN 1.77**



**Figure 8: Directional Deformation**



Figure 9: Closed view of Directional Deformation

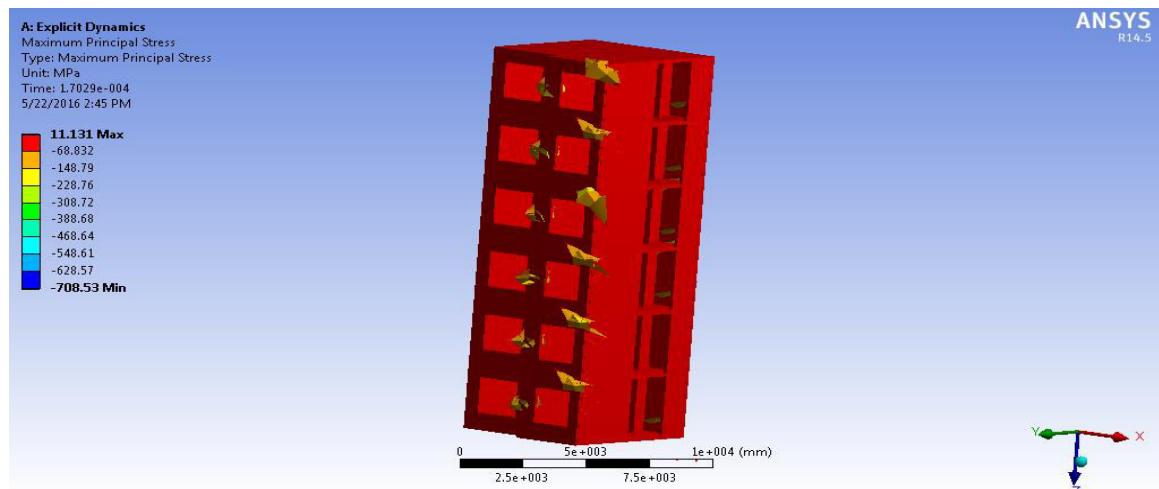


Figure 10: Maximum Principal Stress

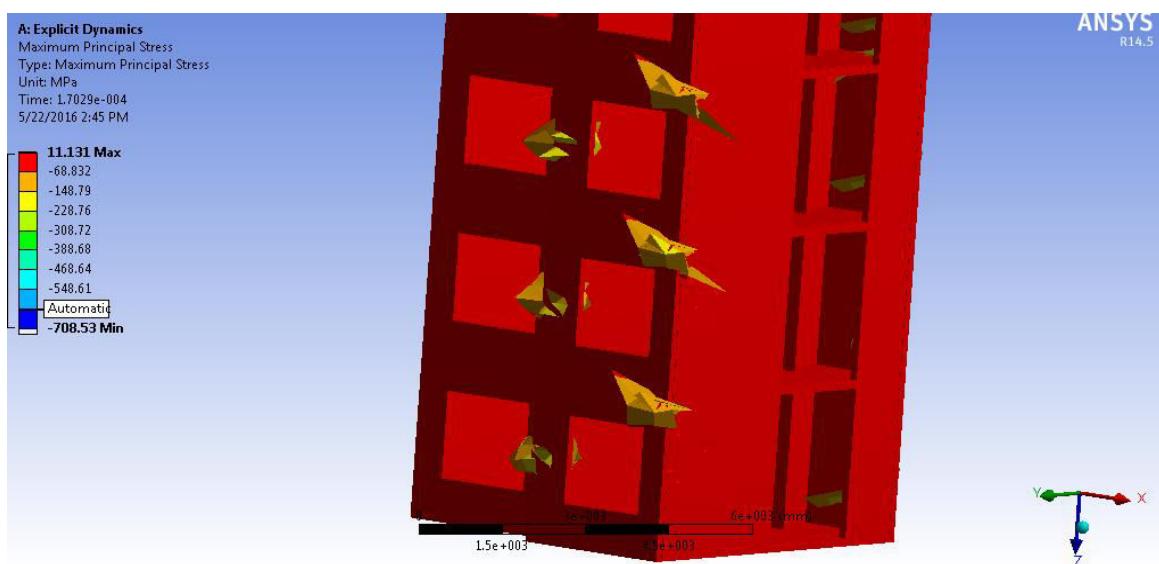
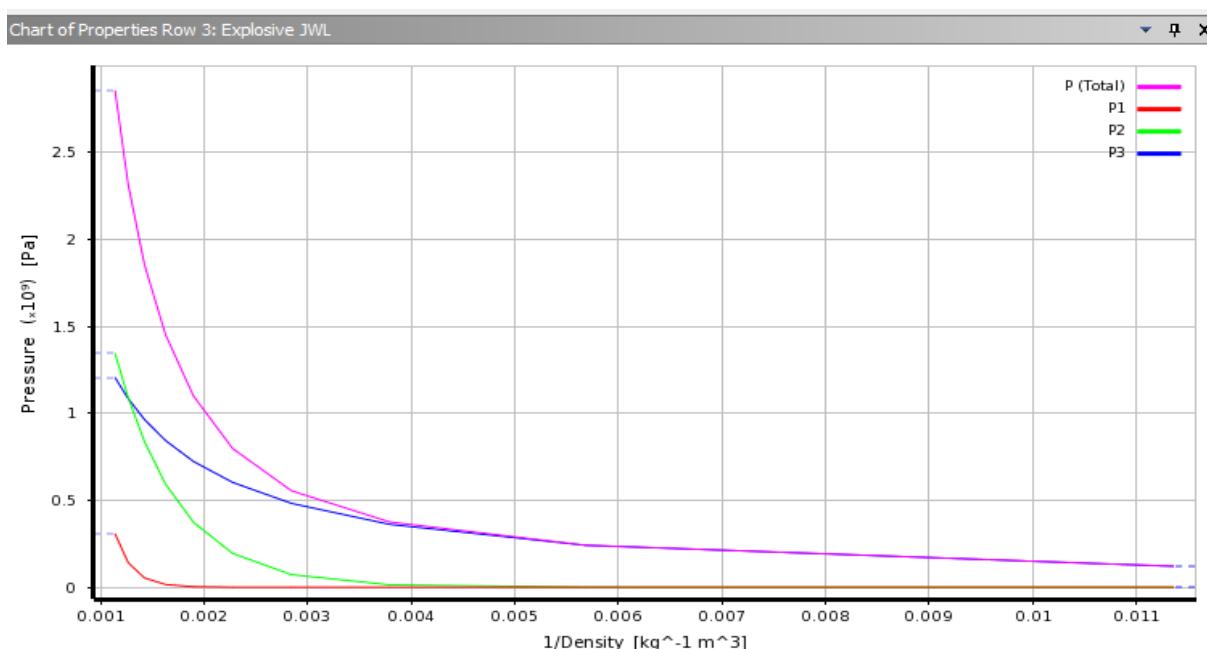


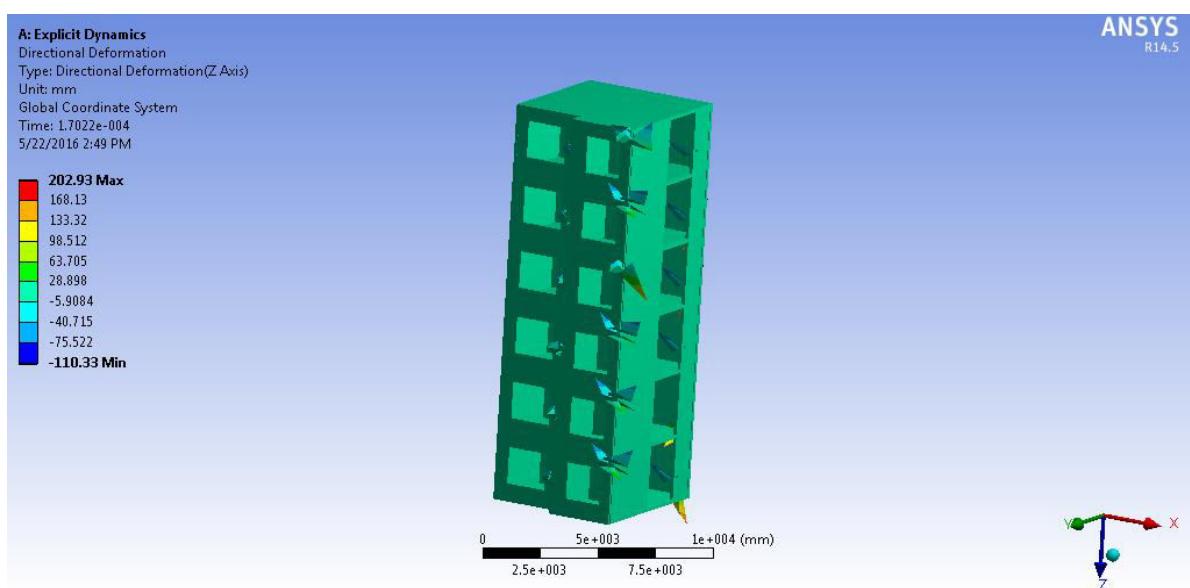
Figure 11: Maximum Principal Stress

**Table 4: Material Properties of Explosive PETN 0.88**

Table of Properties Row 3: Explosive JWL								
	A	B	C	D	E	F	G	H
1	Parameter A (Pa)	Parameter B (Pa)	Parameter R1	Parameter R2	Parameter W	C-J Detonation Velocity ( $m\ s^{-1}$ )	C-J Energy /unit mass ( $J\ kg^{-1}$ )	C-J Pressure (Pa)
2	3.4862E+11	1.1288E+10	7	2	0.24	5170	5.71E+06	6.2E+09



**Figure 12: Graph of material properties of explosive PETN 0.88**



**Figure 13: Directional Deformation**

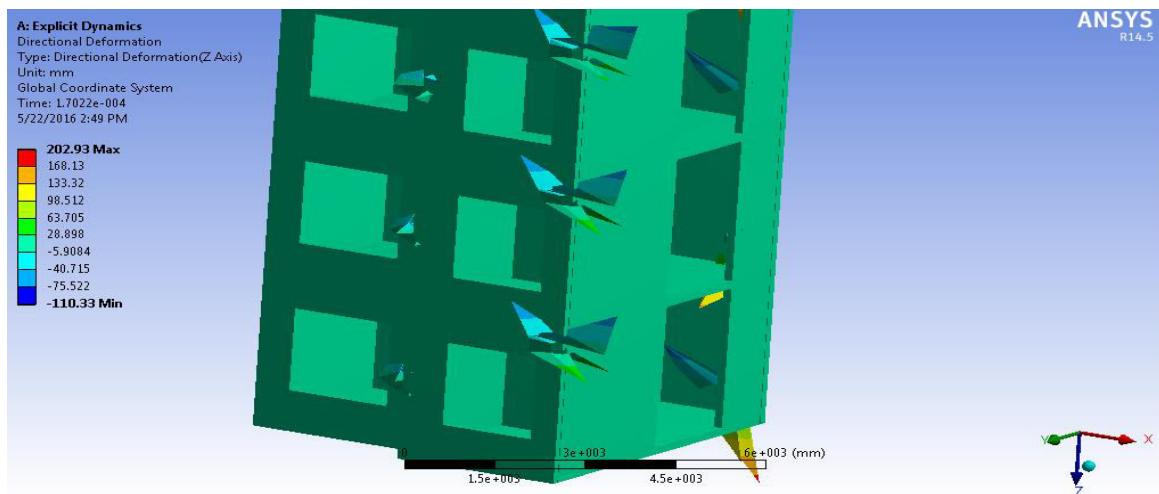


Figure 14: Closed view of Directional Deformation

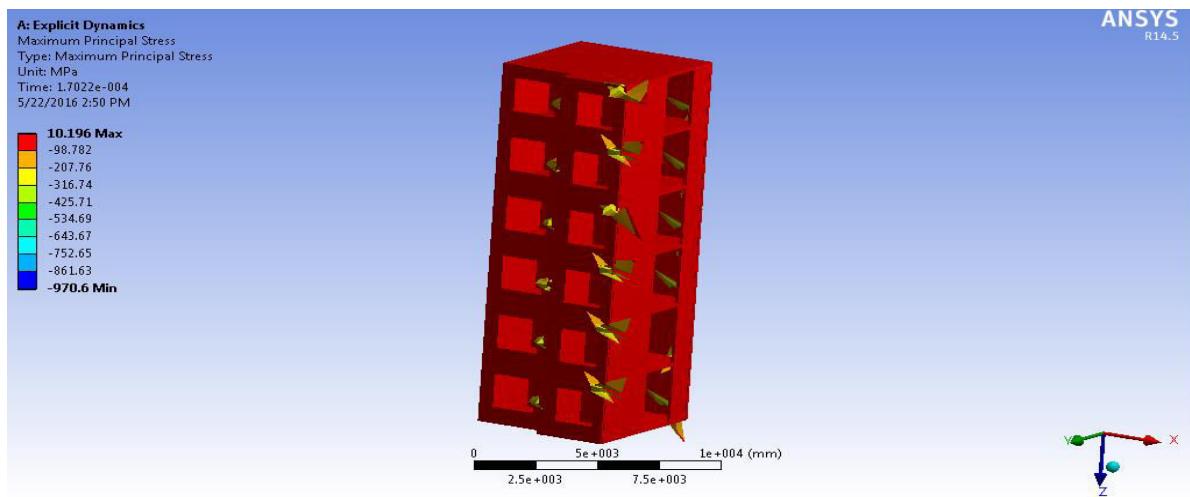


Figure 15: Maximum Principal Stress

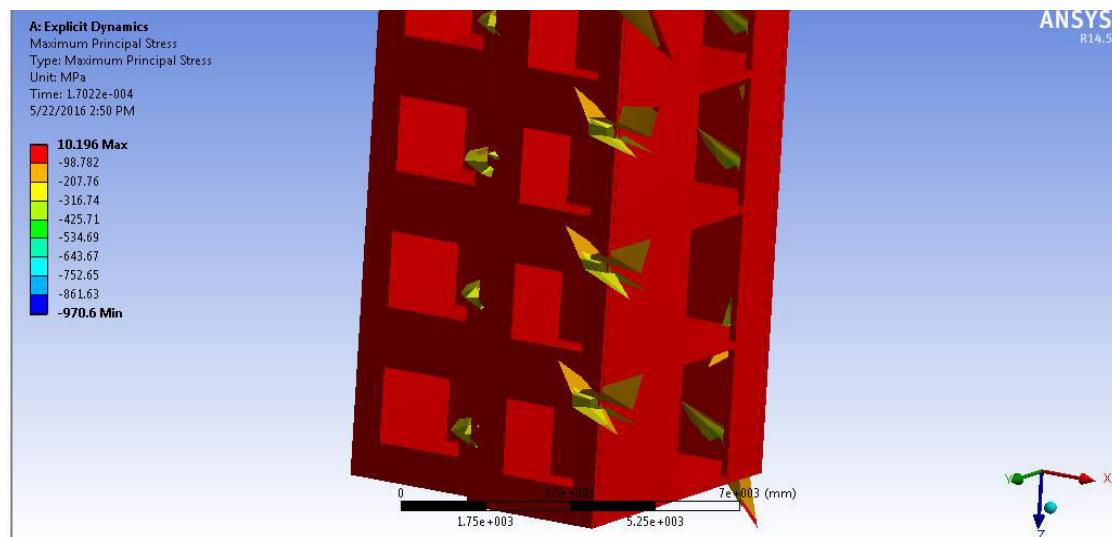
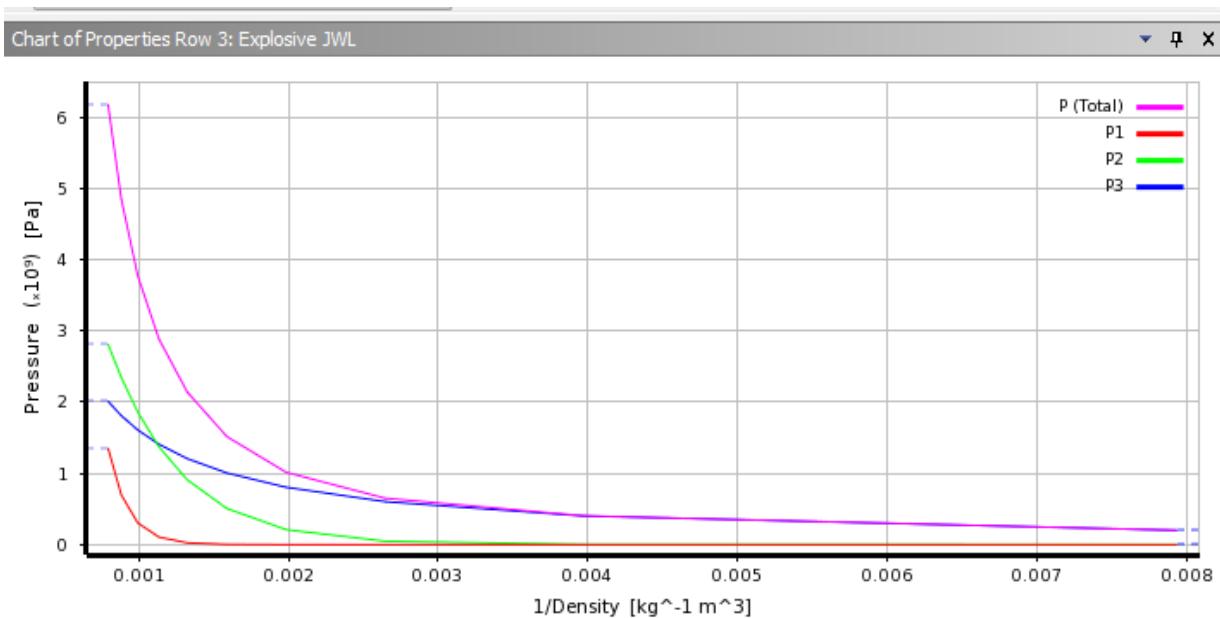


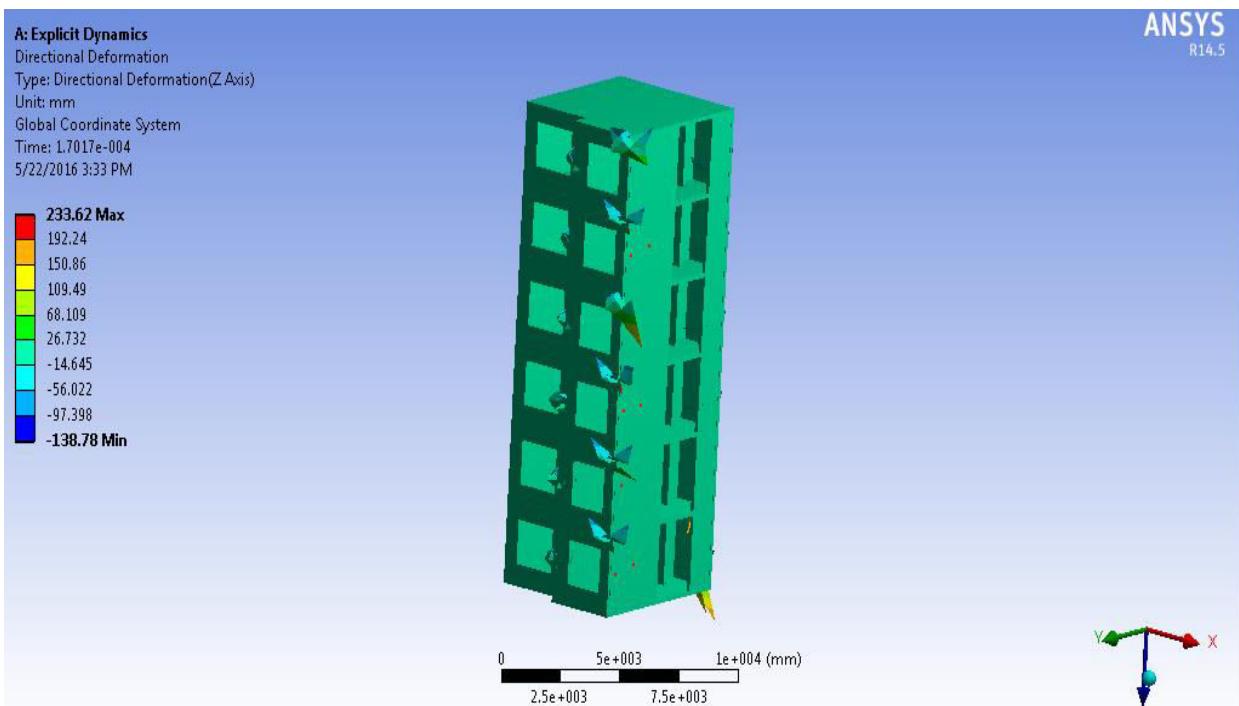
Figure 16: Closed view of Maximum Principal Stress

**Table 5: Material Properties of Explosive PETN 1.26**

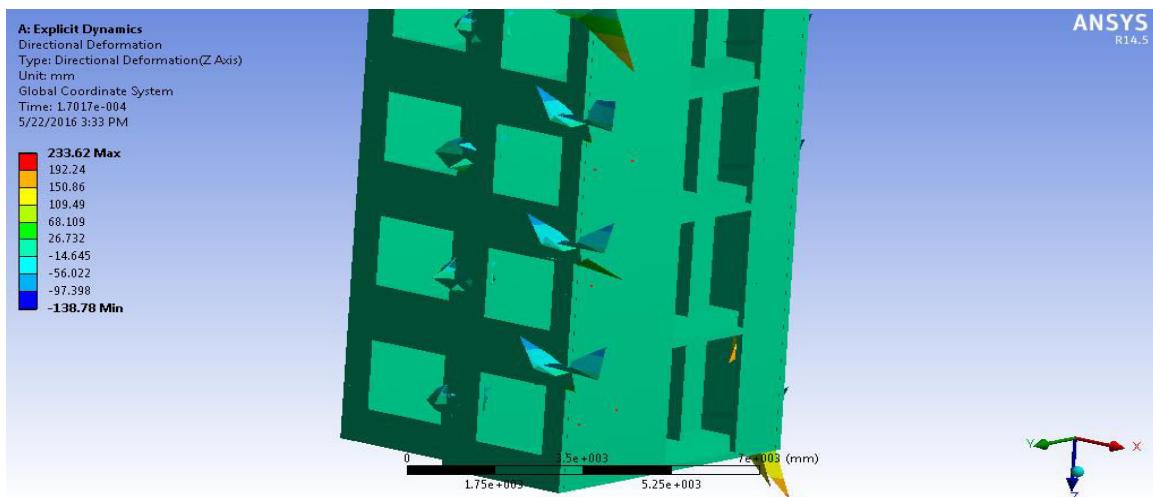
Table of Properties Row 3: Explosive JWL							
	A	B	C	D	E	F	G
1	Parameter A (Pa) ▾	Parameter B (Pa) ▾	Parameter R1	Parameter R2	Parameter W	C-J Detonation Velocity ( $m s^{-1}$ ) ▾	C-J Energy / unit mass ( $J kg^{-1}$ ) ▾
2	5.731E+11	2.016E+10	6	1.8	0.28	6540	5.706E+06



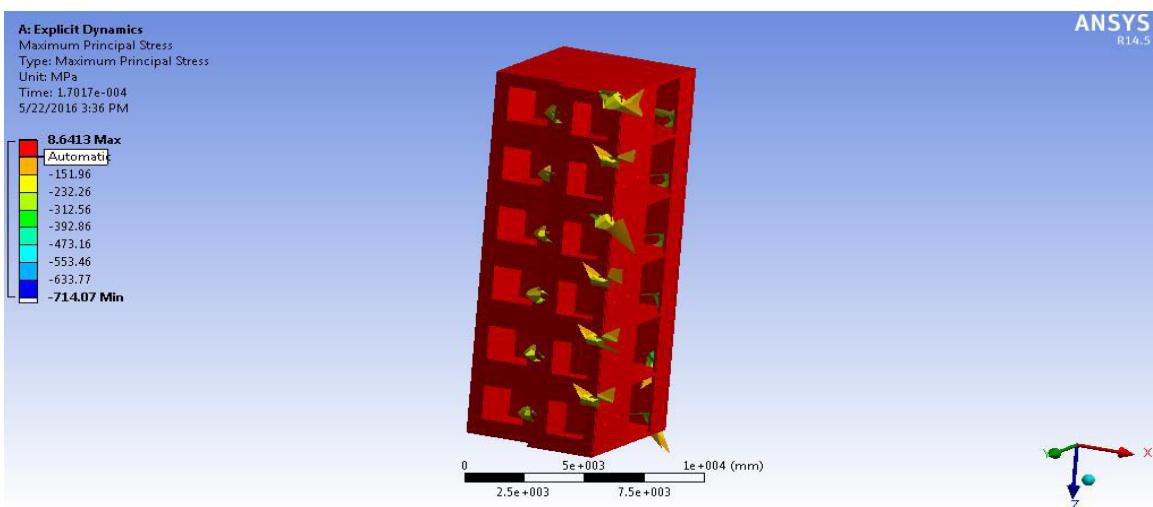
**Figure 17: Graph of material properties of explosive PETN 1.44**



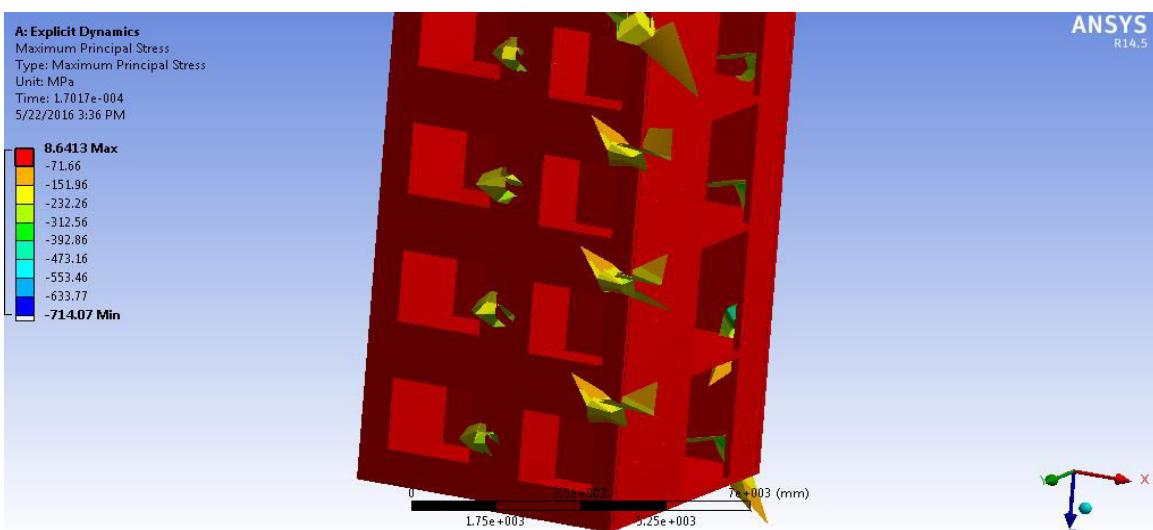
**Figure 18: Directional Deformation**



**Figure 19:** Closed view Directional Deformation



**Figure 20:** Maximum Principal Stress



**Figure 21:** Closed view of Maximum Principal Stress

## 6. OBSERVATION TABLE AND RESULT

Table 6: Deformation and Max. Principle Stress

Explosive Type	Deformation in mm	Max principle stress in MPa
PETN 1.77	292.2	11.131
PETN 0.88	202.93	10.196
PETN 1.26	233.62	8.6413

From above table it is clear that the maximum principal stress generated due to explosive PETN 1.77 is 11.131 MPa and maximum directional deformation is 292.2 mm, which is more than PETN 0.88 and PETN 1.26.

## 7. CONCLUSION

- i. Demolition could be carried out using more than one method. Each method has its advantages and limitations in terms of effectiveness, economy and safety.
- ii. The computational methodology involving use of FEA software appears to be effective and reliable while offering a solution in a short time.
- iii. The parameters could be varied with ease and results can be determined through iterations of the problem.
- iv. This work shall take up the computational technique for study while attempting to find a solution for the problem at hand.
- v. Using detonates in building demolition process, overall time required for demolition get reduced.
- vi. The maximum principal stress generated due to PETN 1.77 explosive is 11.131 MPa and maximum directional deformation is 292.2 mm; which is more than PETN 0.88 and PETN 1.26 explosive.
- vii. The comparison of different parameters gives PETN 1.77 as a best suitable explosive for explosion of building.
- viii. We can save the time, cost and labour by using explosive demolition technique.

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ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

**Volume - 3, Issue -11, July 2016**

**Continuous 35<sup>th</sup> Edition, Page No.: 4056-4077**

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**Akash D. Tiwari, Sneha Sawant, Smita V. Pataskar, Swapnil S. Kulkarni:: Optimization Of Explosives For Demolition Of Structure Using Finite Element Analysis And Sequencing Of Operation**

**4077**

# A New Paradigms for the Internet of Things

Paper ID	IJIFR/V3/ E11/ 020	Page No.	4078-4087	Subject Area	Computer Science
KeyWords	Cyber Physical Systems, Internet Of Things (Iot), Mobile Computing, Pervasive Computing, Wireless Sensor Networks, Virtual Private Networks				

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## Abstract

Many technical communities are vigorously pursuing research topics that contribute to the Internet of Things (IoT). Nowadays, as sensing, actuation, communication, and control become even more sophisticated and ubiquitous, there is a significant overlap in these communities, sometimes from slightly different perspectives. More cooperation between communities is encouraged. To provide a basis for discussing open research problems in IoT, a vision for how IoT could change the world in the distant future is first presented. Then, seven key research topics are enumerated and research problems within these topics are discussed.

## 1. INTRODUCTION

The notions Smart devices, Smart phones, Smart cars, Smart homes, Smart cities—A smart world—have been espoused for many years. Achieving these goals has been investigated, to date, by many diverse and often disjoint research communities. Five such prominent research communities are: Internet of Things (IoT), mobile computing (MC), pervasive computing (PC), wireless sensor networks (WSNs), virtual private networks(VPN) and, most recently, cyber-physical systems (CPS). However, as technology and solutions progress in each of these fields, there is an increasing overlap and merger of principles and research questions. Narrow definitions of each of these fields are no longer appropriate. Further, research in IoT, PC, MC, WSN, VPN and CPS often relies on underlying technologies such as real-time computing, machine learning, security, privacy, signal processing, big data, and others. Consequently, the smart vision of the world involves much of computer science, computer engineering, and electrical engineering. Greater interactions among these communities will speed progress.

In this paper, as a backdrop to identifying research questions, the research discussed is representative rather than complete. Two goals of the paper are: 1) to highlight a number of significant research needs for future IoT systems; 2) to raise awareness of work being performed across various research communities.





## 2. VISION AND IOT SCOPE

Many people [6], including eminent research scholars, data scientists [18], [19], hold the view that cities and the world itself will be overlaid with sensing and actuation, many embedded in “things” creating what is referred to as a smart world. But it is important to note that one key issue is the degree of the density of sensing and actuation coverage. In coming future there will be a transition point when the degree of coverage triples or quadruples from what we have today. At that time, there will be a qualitative change. For example, nowadays, many buildings already have sensors for attempting to save energy [5], [27]; home automation is occurring [3]; cars, taxis, and traffic lights have devices to try and improve safety and transportation [7]; people have smartphones with sensors for running many useful apps [2]; industrial plants are connecting to the Internet [1]; enterprises are also becoming more active on the internet and healthcare services are relying on increased home sensing to support remote medicine and wellness [9]. However, all of these are just the tip of the iceberg. They are all still at early stages of development. The steady increasing density of sensing and the sophistication of the associated processing will make for a significant qualitative change in how we work and live. We will truly have systems-of-systems that synergistically interact to form totally new and unpredictable services.

What will be the platform or platforms that support such a vision? One possibility is a global sensing and actuation utility connected to the Internet .As electricity and water are considered the two utilities that can be used for a myriad of purposes, same way sensing and actuation in the form of an IoT platform will become a utility. IoT will not be seen as individual systems, but as a critical, integrated infrastructure upon which many applications and services can run. Some applications will be personalized such as digitizing daily life activities, others will be city-wide such as efficient, delay-free transportation, and others will be worldwide such as global delivery systems. In cities, perhaps there will be no traffic lights and even 3-D transportation vehicles. Smart buildings will not only control energy or security, but integrate personal comfort, energy savings, security, and health and wellness aspects into convenient and effective spaces. Individuals may have patches of bionic skin with sensing of physiological parameters being transmitted to the cloud which houses his/her digital health, and to the surrounding smart spaces for improved comfort, health, efficiency, and safety. In fact, smart gadgets, body nodes, and clothes will act as personalized input to optimize city-wide services benefiting both the individual and society. Consequently, we will often (perhaps 24/7) be implicitly linked into the new utility. Some examples of new services include immediate and continuous access to the right information for the task at hand, be it, traveling to work or a meeting, exercising, communication, playing games, shopping, socializing, or visiting a doctor. Sometimes these activities will be virtual activities, or even include the use of avatars or robots. Many outputs and displays for users may be holographic. Credit cards should disappear and biometrics such as voice or retinas will provide safe access to buildings, ATMs, and transportation systems.

A sensing and actuation utility will not be limited to public spaces, but also extend into the home, apartments, and condominiums. Here, people will be able to run health, energy, security, and entertainment apps on the infrastructure. Installing and running new apps will be as easy as plugging in a new toaster into the electric utility. One app may help monitor and control heart rate, another perform financial and investments services, and another automatically ordering food and wine, or even predicting an impending medical problem that should be addressed early to mitigate or even avoid the problem. Humans will often be the integral parts of the IoT system. The industrial Internet is also a form of IoT where the devices (things) are objects in manufacturing plants, dispatch centers, process control industries, etc. Consequently, in the future, the scope of IoT is enormous and will affect every aspect of all our lives.

### 3. RESEARCH REQUIREMENT

The spectrum of research required to achieve IoT at the scale envisioned above requires significant research along many directions. In this section, problems and required research are highlighted in seven topic areas: architecture and dependencies, robustness, creating knowledge and Big Data, security, mobility, interoperability and privacy. Each of the topic discussions primarily focuses on new problems that arise for future IoT systems of the type described in Section 2. The research topics presented in each case are representative and not complete. Many important topics such as the development of standards, the impact of privacy laws, and the cultural impact on use of these technologies are outside the scope of this paper.

#### A. Architecture and Dependencies

As trillions of things (objects) are connected to the Internet, it is necessary to have an adequate architecture that permits easy connectivity, control, communications, and useful applications. How will these objects interact in and across applications [26]? Many times, things or sets of things must be disjoint and protected from other devices. At other times, it makes sense to share devices and information. One possible architectural approach for IoT is to borrow from the smartphone world [2], [4]. Smartphones employ an approach where applications are implemented and made available from an app store. This has many advantages including an unbounded development of novel applications that can execute on smartphones. Various standards and automatic checks are made to ensure that an app can execute on a given platform. For example, the correct version of the underlying operating system (OS) and the required sensors and actuators can be checked when the app is installed [10]. A similar architectural approach for IoT would also have similar advantages. However, the underlying platform for IoT is much more complicated than for smartphones. Nevertheless, if IoT is based on an underlying sensor and actuator network that acts as a utility similar to electricity and water, then, different IoT applications can be installed on this utility. While each application must solve its own problems, the sharing of a sensing and actuation utility across multiple simultaneously running applications can result in many systems-of-systems interference problems, especially with the actuators. Interferences arise from many issues, but primarily when the cyber depends on

assumptions about the environment, the hardware platform, requirements, naming, control, and various device semantics. Previous work, in general, has considered relatively simple dependencies related to numbers and types of parameters, versions of underlying OSs, and availability of correct underlying hardware. Research is needed to develop a comprehensive approach in specifying, detecting, and resolving dependencies across applications. This is especially important for safety critical applications or when actuators can cause harm. Let us consider a few examples of dependencies [13], [20], [21]. Assume that we integrate several systems responsible for energy management (controlling thermostats [11], windows, doors, and shades) and home health care (controlling lights, TVs, body nodes measuring heart rate and temperature, and sleep apnea machines [22]). If information can be shared, this would allow the energy management system to adjust room temperature depending on the physiological status of the residents as detected by the home health care system. Also, integration will allow avoiding negative consequences. For example, the integrated system will not turn OFF medical appliances to save energy, while they are being used as suggested by the home health care system. In addition to these advantages, all the systems can share sensors and actuators, which will reduce the cost of deployment, improve aesthetics of the rooms, and reduce channel contention. However, integrating multiple systems is very challenging, as each individual system has its own assumptions and strategy to control the physical world variables without much knowledge of the other systems, which leads to conflicts when these systems are integrated without careful consideration. For example, a home health care application may detect depression and decide to turn ON all the lights. On the other hand, the energy management application may decide to turn OFF lights when no motion is detected. Detecting and resolving such dependency problems is important for correctness of operation of interacting IoT systems.

### B. Robustness

If our vision is correct, many IoT applications will be based on a deployed sensing, actuation, and communication platform (connecting a network of things). In these deployments, it is common for the devices to know their locations, have synchronized clocks, know their neighbor devices when cooperating, and have a coherent set of parameter settings such as consistent sleep/ wake-up schedules, appropriate power levels for communication, and pair-wise security keys. However, over time, these conditions can deteriorate. The most common (and simple) example of this deterioration problem is with clock synchronization [12]. Over time, clock drift causes nodes to have different enough times to result in application failures. While it is widely recognized that clock synchronization must reoccur, this principle is much more general. For example, some nodes may be physically moved unexpectedly. More and more nodes may become out of place over time. To make system-wide node locations coherent again, node relocalization needs to occur (albeit at a much slower rate than for clock sync). This issue can be considered a form of entropy where a system will deteriorate (tend toward disorder) unless energy in the form of rerunning protocols and other self-healing mechanisms is

applied [24]. Note that control of actuators can also deteriorate due to their controlling software and protocols, but also due to physical wear and tear. In other words, how can a long-lived, dynamic, and mobile IoT be maintained?

The required coherence (entropy) services must combine with many other approaches to produce robust system operation. This includes formal methods to develop reliable code, *in situ* debugging techniques, online fault tolerance, in-field maintenance, and general health monitoring services [15]–[17]. These problems are exacerbated due to the unattended operation of the system, the need for a long lifetime, the openness of the systems, and the realities of the physical world. The goal is for this collection of solutions to create a robust system in spite of noisy, faulty, and nondeterministic underlying physical world realities.

Another problem merely addressed to date is that in some IoT applications, especially safety critical ones, run time assurances must be given to authorities, e.g., to (re)certify that the system is operating as expected. Consider a fire fighting system deployed in a skyscraper office building to detect fires, alert fire stations, and aid in evacuation. Periodically, it is necessary to demonstrate to certification authorities that this system meets these requirements. Such IoT applications will need services that can support run-time certification.

### C. Creating Knowledge and Big Data

In an IoT world, there exists a vast amount of raw data being continuously collected. It will be necessary to develop techniques that convert this raw data into usable knowledge. For example, in the medical area, raw streams of sensor values must be converted into semantically meaningful activities performed by or about a person such as eating, poor respiration, or exhibiting signs of depression. Main challenges for data interpretation and the formation of knowledge include addressing noisy, physical world data, and developing new inference techniques that do not suffer the limitations of Bayesian or Dempster–Shafer schemes. These limitations include the need to know the *a priori* probabilities and the cost of computations. Rule-based systems may be used, but may also be too *ad hoc* for some applications. The amount of collected data will be enormous. It can be expected that a very large number of real-time sensor data streams will exist, that it will be common for a given stream of data to be used in many different ways for many different inference purposes, that the data provenance and how it was processed must be known, and that privacy and security must be applied. Data mining techniques are expected to provide the creation of important knowledge from all this data. Enabling streams to act as primitives for unexpected future inferences is an interesting research problem. In addition, the overall system solution must deal with the fact that no inference method is 100% correct. Consequently, uncertainty in interpreted data can easily cause users not to trust the system.

Trust is one important aspect of the usefulness of big data. However, as a basis for trust, it is also necessary to develop new in-field sensor calibration techniques and reliable transport protocols. Without these basic underlying system-level capabilities, further inference might be operating with wrong or too much missing data, resulting in wrong conclusions. If these wrong conclusions drive actuators, then serious safety problems can

occur. One approach is to ensure that all inferred information is accompanied by a confidence level in the form of a probability that the information is correct or incorrect and use that information to guarantee safe actuator operation. In many applications, informing users how information was derived is necessary. Another main challenge is making good (control) decisions using the created knowledge. However, in making decisions, it is necessary to minimize the number of false negatives and false positives and guarantee safety; otherwise, the system will be dismissed as unreliable.

Many IoT applications will be designed to work for a particular person. It is necessary to perform correct data association ensuring that the collected data and subsequent inferences are associated with the correct individual or individuals. This is a very challenging problem for many situations. When users are wearing RFIDs or when cameras with pattern recognition are used, then the problem is solved (except for the privacy issues).

Sometimes, in other situations, it will be necessary to combine a set of current sensor readings with some of the past readings and utilize a history of a given user's activities and personal characteristics to arrive at an accurate data assignment. Extensive research is required on this problem.

#### D. Security

A fundamental problem that is persistent in the Internet nowadays that must be solved is dealing with security attacks [14], [25]. Security attacks are problematic for the IoT because of the minimal capacity "things" (devices) is used, the physical accessibility to sensors, actuators, and objects, and the openness of the systems, including the fact that most devices will communicate wirelessly. The security problem is further exacerbated because transient and permanent random failures are commonplace and failures are vulnerabilities that can be exploited by attackers. However, the considerable redundancy that is available creates potential for designing applications to continue to provide their specified services even in the face of failures. To meet realistic system requirements that derive from long lived and unattended operation, IoT applications must be able to continue to operate satisfactorily in the presence of, and to recover effectively from, security attacks. Solutions may require downloading new code [8] and this it is open to security attacks. The system must also be able to adapt to new attacks unanticipated when the system was first deployed. These problems are beginning to be addressed by work such as that found in [23]. In [23], the system operates with a base level of support including strong attack detection capabilities. Once an attack is detected, then reaction to it occurs, by self-healing.

To heal from security attacks, a system needs to detect the attack, diagnose the attack, and deploy countermeasures and repairs, but perform all of this in a lightweight manner due to the types of low-capacity devices involved. Most of today's main-frame security solutions require heavyweight computations and large memory requirements, so solutions for IoT are major research challenges. Ideally, for a quick response, given the real-time nature of many IoTs, the detection, countermeasures, and repairs must run in real-time as part of a runtime self-healing architecture. Sometimes, healing requires reprogramming,

e.g., when an unanticipated attack occurs. In these cases, healing instructions need to be securely (with authentication and attestation) delivered to the appropriate nodes and then the node's running programs need to be amended by the runtime architecture. It is likely that significant hardware support [14] will be necessary for providing encryption, authentication, attestation, and tamper proof keys. Even if new devices are security-aware, dealing with legacy devices will prove difficult.

#### E. Mobility

Mobility is another challenge for the IoT implementations because most of the services are expected to be delivered to mobile users. Connecting users with their desired services continuously while on the move is an important premise of the IoT. Service interruption for mobile devices can occur when these devices transfer from one gateway to another. [28] proposes a resource mobility scheme that supports two modes: caching and tunneling to support service continuity. These methods allow applications to access the IoT data in the case of the temporary unavailability of resources. The enormous number of smart devices in IoT systems also requires some efficient mechanisms for mobility management. A feasible approach has been presented in [29]. In this scheme, group mobility is managed by a leader based on some similarity metric that is based on the mobility pattern of devices.

Another mobility management scheme is proposed in [30] in which the mobility of sensor nodes as well as service availability are addressed by providing a distributed service lifecycle management mechanism. This technique controls the lifecycle of web service instances that represent a sensor. Internet of Vehicles (IoV) as an emerging area of the IoT needs a precise attention to the mobility issues. [31] Discusses various solutions that support mobility for vehicle-to-vehicle networking. A group mobility mechanism for mobile ad-hoc networks is presented in [32] that is inspired from birds flying in flocks.

#### F. Interoperability

End-to-end interoperability is another challenge for the IoT due to the need to handle a large number of heterogeneous things that belong to different platforms. Interoperability should be considered by both application developers and IoT device manufacturers to ensure the delivery of services for all customers regardless of the specifications of the hardware platform that they use. For example, most of the smartphones nowadays support common communication technologies such as WiFi, NFC (Near Field communication), and GSM (Global System For Mobile Communication) to guarantee the interoperability in different scenarios. Also, programmers of the IoT should build their applications to allow for adding new functions without causing problems or losing functions while maintaining integration with different communication technologies. Consequently, interoperability is a significant criterion in designing and building IoT services to meet customers' requirements [33]. Beside numerous protocols, different interpretations of the same standard implemented by different parties' presents a challenge for interoperability [34].

#### G. Privacy

The ubiquity and interactions involved in IoT will provide many conveniences and useful services for individuals, but also create many opportunities to violate privacy. To

solve the privacy problem created by IoT applications of the future, the privacy policies for each (system) domain must be specified. Once specified, either the individual IoT application or the IoT infrastructure (e.g., the utility capability) must enforce privacy. Consequently, the IoT paradigm must be able to express users' requests for data access and the policies, such that the requests can be evaluated against the policies in order to decide if they should be granted or denied. A new language is required to express privacy policies because the following requirements not *easily* expressed in current privacy languages.

- 1) The need to represent high-level aggregating requests such as querying the average, maximum, or minimum reading of specified sensing data. This capability must be supported by anonymizing aggregation functions. This capability needs to exist for real-time streams and across the big data repositories. Note that inference is very powerful, and having access to vast amounts of data and inference techniques, it is often easy to violate privacy in spite of anonymization.
- 2) The need to support not only adherence to privacy for queries of data (pulling data value from the system), but also privacy on requests to set a system's parameters (pushing new values to the system), e.g., a private use of an actuator.
- 3) The need to allow dynamic changes to the policies, and perform a myriad of analyses some of which are context-dependent.
- 4) The need to express different types of context in the environment such as time, space, physiological sensing, environmental sensing, and stream-based noisy data. Most of the context needs to be collected and evaluated in real-time. But what will collect policies and data and support privacy? Is it the utility infrastructure, an individual application, both, or some new approach?

The need to represent different types of data owners and request subjects in the system as well as external users and their rights when domains interact. Unlike other privacy enforcing systems where the subjects and data owners are human individuals or groups, an IoT privacy language might also support physical entities such as "refrigerator," "room," "floor," and other system entities (things) as request issuers and data owners. One of the more difficult privacy problems is that systems interact with other systems, each having their own privacy policies. Consequently, inconsistencies may arise across systems in the IoT world. Online consistency checking and notification and resolution schemes are required.

#### 4. CONCLUSION

The development of the IoT exposed many new challenges including the lack of fundamental theory supporting, unclear architecture, and immature standards. The future of IoT will be expected to be unified, seamless, and pervasive. Large-scale service deployment needs to be framed within a set of standards. Thus, the developments of IoT as an intelligent system can be proceeding with interoperability, energy sustainability, privacy, and security. It is hoped that there is more cooperation between the research

communities in order to solve the myriad of problems sooner as well as to avoid reinventing the wheel when a particular community solves a problem.

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ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

Volume - 3, Issue -11, July 2016

Continuous 35<sup>th</sup> Edition, Page No.: 4078-4087

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# Investigation On The Radiation Patterns For The Combination Of Array Of Isotropic Radiators And Array Of Practical Elements

Paper ID

IJIFR/V3/ E11/ 022

Page No.

4088-4100

Subject Area

Elec. & Comm.  
Engg.

KeyWords

Dolph-Chebyshev Synthesis, Microstrip Element, Array Antennas

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**Abstract**

Radiation pattern shape plays a major role in all communication and in modern radar systems. It is of interest to note that it is possible to generate and shape the overall radiation characteristics by suitable design of antennas. In view of these facts, an attempt is made to propose new amplitude distributions to reduce the side lobe level for synthesis of monopulse antennas and combination of practical radiating elements. In this present work, intensive studies are carried out to generate patterns from arrays of isotropic radiators and array of practical elements for both small and large arrays.

**1. INTRODUCTION**

There are many applications where the antenna pattern is required to be shaped to achieve a desired effect. It is well known that the array antennas are extensively used as they provide high gain, directivity and desired pattern shapes easily. They are preferred over discrete antennas in both ground borne and air borne applications [1]-[3]. Design is one of the most important aspects in research problems. Under antenna design, pattern synthesis is another important task of antenna designer. This task is applied for array of isotropic radiators and array of practical radiators.

Schelkunoff [4] developed an excellent general concept on pattern synthesis. He brought out a relationship between pattern shape and the polynomial zeros. Woodward [5] used orthogonal sinusoidal expansions which match the desired pattern with a number of points in the space. In fact, this is one of the useful techniques for pattern synthesis. The method of determination of phase function for a continuous line source producing a desired one-dimensional pattern has reported by authors [6].



The main aim of this present work is to determine the radiation characteristics for the combination of array pattern synthesis and practical radiating elements. There are several traditional and conventional pattern synthesis methods in which Dolph-Chebyshev synthesis is a method for design of amplitude distribution through suitable polynomials. It provides amplitude distribution by which radiation pattern with equal side lobe levels can be realized.

Dolph [7] has derived an optimum current distribution for equispaced broadside arrays based upon the properties of Tschebysheff polynomials. In designing linear arrays that would produce antenna patterns replicating the chebyshev characteristics; he was able to show that for linear arrays of discrete radiators, spaced a half wavelength apart, an optimality condition exists in that Dolph-Chebyshev patterns provide a minimum beam width for a given side-lobe level. The excitation coefficients for the sum pattern are calculated from the Dolph-Chebyshev method with fixed SLL.

The desired radiation pattern contains an element and space factors. The element factor depends upon the type and the orientation of fields, which makeup a typical segment of the source. In general, it has little directivity. The space factor is highly directive. It depends on the relative variation of the field along the source. In view of these facts, an attempt has been made in this paper to compute the synthesis of isotropic radiators and practical radiators.

Array of isotropic radiators are able to produce any type of beam shape depending on its application. The major advantage of antenna arrays over a single antenna element is their electronic scanning capability that is, the major lobe can be steered towards any direction by changing the phase excitation at each array element. The objective of using practical element is to meet the above requirements more than a conventional antenna to suppress the side lobe level. The main aim of this paper is to analyze and design a rectangular microstrip antenna [8]-[9] with specific parameters like length, width, height of the patch, and dielectric constant of the substrate. Microstrip antenna determines the configuration of radiation pattern with desired specifications. The usage of the microstrip antennas is spreading widely in all the fields and areas and now they are booming in almost all commercial aspects.

## 2. PROBLEM FORMULATION PROCEDURE

### 2.1. Synthesis Procedure:

The concepts of half-power beam width and peak directivity of a linear antenna array pattern are introduced and it is applied to the case of sum patterns. For this purpose a well-known technique called Dolph-Chebyshev synthesis method [10] is widely used. It is a compromise between uniform and binomial arrays. In this method the sum pattern assumed to be symmetric that consists of a narrow beam in the bore sight direction which is associated with one major lobe and at equal heights of number of minor lobes. The main objective of this work is to acquire a proper weighing vector and layout of elements to reduce the side lobe level and generate desired radiation pattern.

The Dolph-Chebyshev is optimum [11] in the sense that, for a given minimum desired sidelobe level  $R$ , the narrowest main lobe width will be achieved by a window whose sidelobes are all equal to ' $R$ ' dB. Conversely, for a given maximum desired main lobe width, the largest sidelobe attenuation will be achieved by window with equal sidelobe levels. This "Optimum" window is the Dolph-Chebyshev window, which is constructed with the help of chebyshev polynomials. Its excitation coefficients are related to Tchebyshev polynomials. The Dolph array design for zero sidelobes reduces to the binomial design. The recursion formula for  $m^{\text{th}}$  Tchebyshev polynomial  $T_m(z)$  is given below the equation

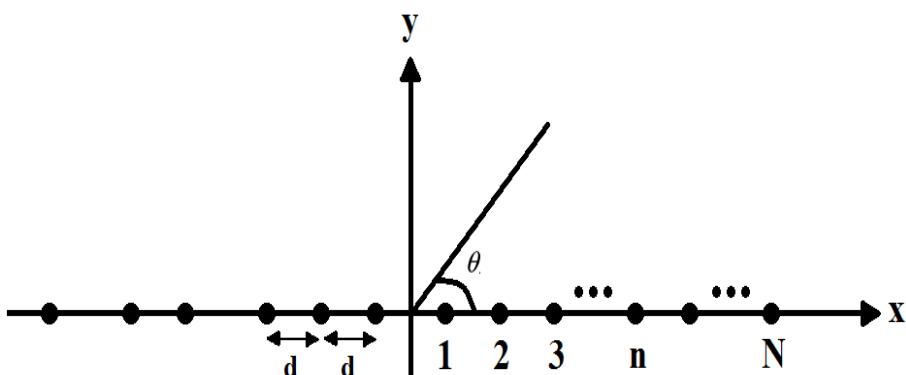
$$T_m(z) = 2z T_{m-1}(z) - T_{m-2}(z) \quad (1)$$

Each polynomial can also be computed using

$$T_m(z) = \cos(m \cos^{-1}(z)) \quad -1 \leq z \leq +1 \quad (2)$$

$$T_m(z) = \cos(m \cosh^{-1}(z)) \quad z < -1, z > +1 \quad (3)$$

Consider an array of isotropic elements positioned symmetrically along the X-axis. Suppose the distance between any two adjacent elements is 'd', and the array is operated at  $\lambda/2$ , a symmetric linear array is shown in figure (1).



**Figure 1: Geometry for 2M element linear array.**

The array factor for this array will be determined assuming that all elements are excited with the same current phase ( $\phi = 0^\circ$  for simplicity) but non-uniform current amplitudes. The amplitude distribution assumed to be symmetric about the origin. The array factor for the sum pattern is given in the following equation

$$AF_s(\theta) = \sum_{n=1}^{M} a_n \cos\left[\frac{1}{2}(2n-1)k d \cos\theta\right] \quad (4)$$

Where,      ' $a_n$ ' are the complex excitation coefficients

    'k' is the wave number,

    ' $\theta$ ' defines the angle at which  $AF(\theta)$  is calculated with respect to the broadside direction.

    'd' is the inter-element distance.

The sum pattern coefficients  $a_0, a_1, a_2$  etc., of antenna can be calculated using the dolph design procedure. These weights give the required amplitude distribution for the specified sidelobe ratio 'R' dB.

## 2.1. Analytical Considerations of Microstrip Element

A microstrip patch antenna is a narrowband, wide-beam antenna constructed by engraving the antenna element pattern joined to an insulating dielectric substrate on one side and a continuous metal layer joined to the opposite side of the substrate which forms a ground plane [12]. The effective design of microstrip antennas requires good knowledge of the effects of the physical and mechanical properties of the patch, the ground plane, and the substrate material of the antenna.

### 2.1.1. Element Width

The width of the patch is equal to about half a wavelength and leads to good radiation efficiencies and it is given by the equation

$$W = \frac{c_0}{2f_r} \sqrt{\frac{2}{\epsilon_r + 1}} \quad (5)$$

Where,  $c_0$  is the speed of the light

$\epsilon_r$  is Relative permittivity and

$f_r$  is Resonant frequency for maximum radiation.

### 2.1.2. Element Length

The length of the patch L controls the resonant frequency. The length may also be specified by calculating the half wavelength value and then subtracting a small length to take into account the fringing fields. The length of the patch is followed by the equation

$$L = \frac{c_0}{2f_r \sqrt{\epsilon_{\text{reff}}}} - 2\Delta L \quad (6)$$

Where,

$\Delta L$  = Distance between patch and edge of the substrate and  $\Delta L$  is given by

$$\Delta L = 0.412h \frac{(\epsilon_{\text{reff}} + 0.3) \left( \frac{W}{h} + 0.264 \right)}{(\epsilon_{\text{reff}} - 0.258) \left( \frac{W}{h} + 0.8 \right)} \quad (7)$$

Where,

$h$  = height of the substrate.

W= width of the patch

$f_r$ = Resonant frequency for maximum radiation and  $f_r$  is given by

$$f_r = \frac{c_0}{2L\sqrt{\epsilon_r}} \quad (8)$$

$\epsilon_{\text{eff}}$ = Effective permittivity of the substrate and  $\epsilon_{\text{eff}}$  is given by

$$\epsilon_{\text{eff}} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[ 1 + 12 \frac{h}{W} \right]^{-\frac{1}{2}}, \frac{W}{h} > 1 \quad (9)$$

Where,  $c_0$  is the velocity of light.

$f_0$  is the resonant frequency and

$\epsilon_r$  is the dielectric constant of the substrate.

### 2.1.3. Field Expressions

E plane is the plane in which the electric field is dominant and this is justified for H plane too. The expressions for E-and H-planes are given by

$$E_\theta = \frac{\sin \left[ \frac{kwsin\theta sin\phi}{2} \right]}{\frac{kwsin\theta sin\phi}{2}} \cos \left[ \frac{kLsin\theta cos\phi}{2} \right] \cos\theta \quad (10)$$

$$E_\phi = \frac{\sin \left[ \frac{kwsin\theta sin\phi}{2} \right]}{\frac{kwsin\theta sin\phi}{2}} \cos \left[ \frac{kLsin\theta cos\phi}{2} \right] \cos\theta \sin\phi \quad (11)$$

$\Phi=0$ , represents E plane and

$\theta=0$ , represents H plane.

### 2.2. Desired Array Pattern

Array antennas are several antenna elements connected and arranged in a linear array to reduce the electromagnetic environment pollution by suppressing the sidelobe level and steering nulls to the direction of interference signal as well as placing the main beam directed towards the desired signal. Here practical radiating element microstrip patch is multiplied with isotropic radiator dolph chebyshev array to get the desired radiation pattern with reduced sidelobe level. These radiation patterns are very useful for the range detection of the target in the applications of radar.

Desired Array pattern = Element pattern \* Array factor

Element pattern = Microstrip antenna with dimensions

Array factor = sum pattern obtained by dolph chebyshev synthesis method

$$\text{Desired array pattern} = \text{AF}_s(\theta) * E_\theta \quad (12)$$

### 3. NUMERICAL SIMULATION RESULTS AND DISCUSSION

In order to validate the effectiveness of proposed method we first investigate a linear array of isotropic radiators of 20 and 60 elements that are spaced at a distance of  $\lambda/2$  apart. The sum pattern excitation coefficients are obtained in dolph-chebyshev synthesis method and according to the dimensions of patch antenna we will observe the radiation pattern for the practical radiating element. Here in this present work the practical isotropic radiator is microstrip patch antenna. To get the desired radiation pattern, the element pattern is multiplied with the sum array pattern. By considering the frequency of 30GHz, the microstrip patch dimensions are changed accordingly to  $k=6.283$  cm,  $w=0.3968$  cm,  $L=0.099$  cm and  $h=0.1588$  cm and the radiation patterns are clearly observed.

The sum pattern excitation coefficients for the 20 and 60 elements are obtained by using dolph-chebyshev synthesis method and the corresponding amplitude distributions that are shown in the figures (2) and (4). The radiation pattern with reduced SLL= -45dB for sum array are obtained by using the equation (4) and the corresponding desired array patterns of 20 and 60 elements are obtained using the equation (12) that are shown in the figures (3) and (5).

Similarly, the amplitude excitation coefficients for 20 and 60 elements with reduced SLL= -60dB are shown in the figures (6) and (8) and the corresponding desired radiation patterns are shown in the figures (7) and (9). Finally observe the amplitude coefficients of 20 and 60 elements for suppressed SLL= -80dB in the figures (10), (12) and the corresponding desired radiation patterns of isotropic radiators are shown in the figures (11) and (13).

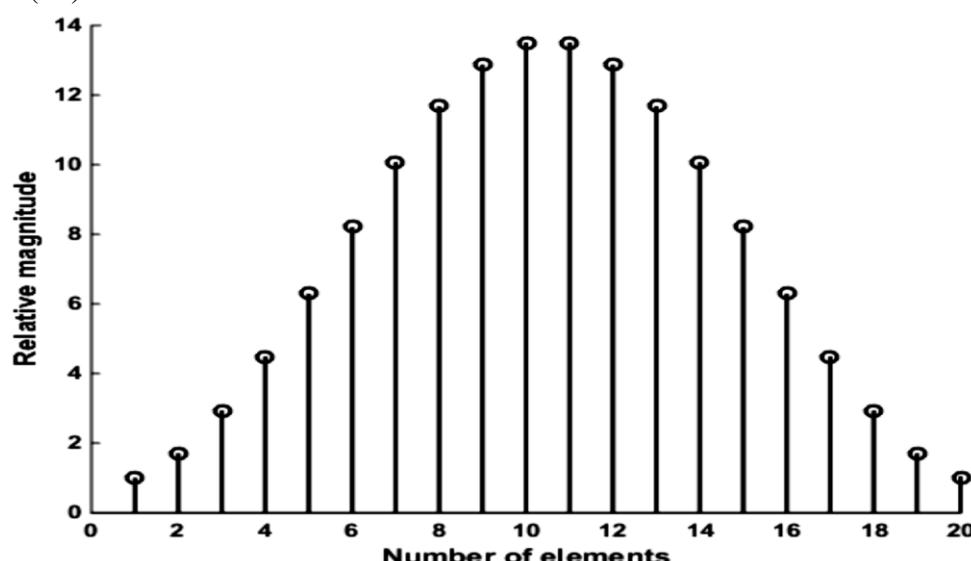


Figure 2: Amplitude distribution for the sum pattern of 20 elements for SLL= -45dB

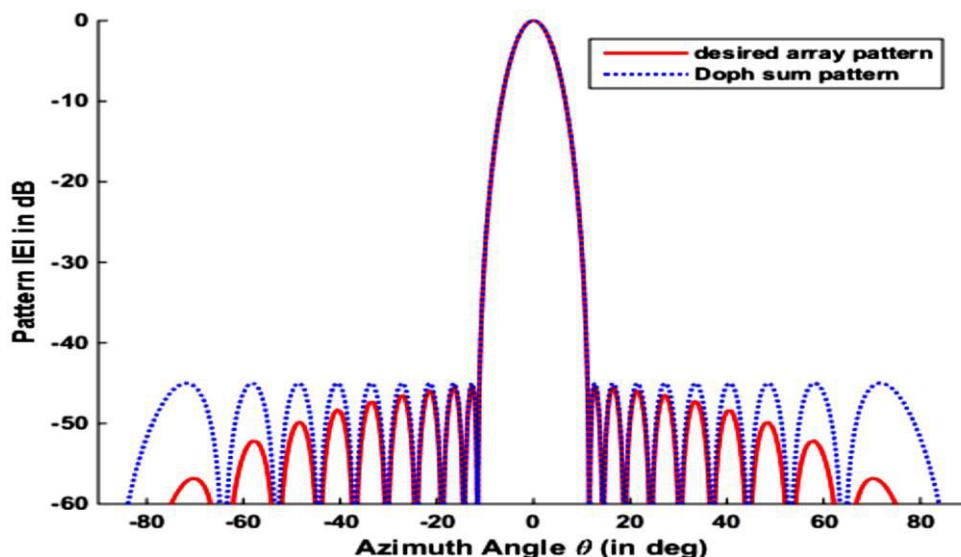


Figure 3: Radiation Patterns for 20 elements with SLL= -45dB

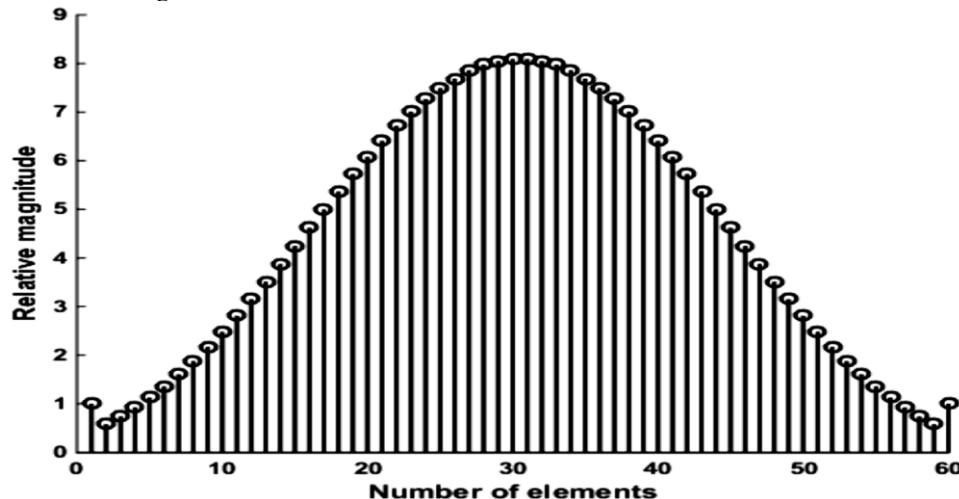


Figure 4: Amplitude distribution for the sum pattern of 60 elements for SLL= -45dB

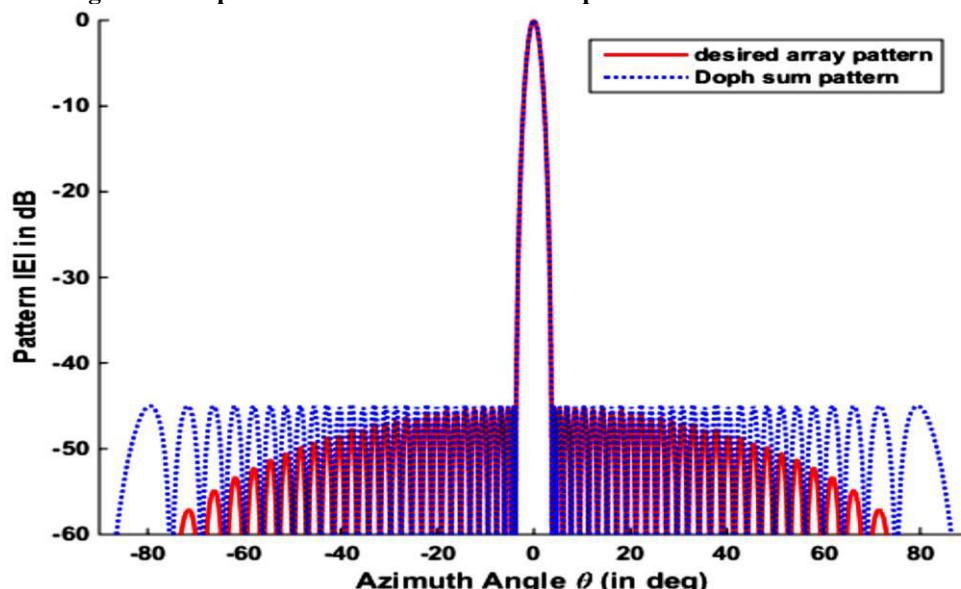


Figure 5: Radiation Patterns for 60 elements with SLL= -45dB

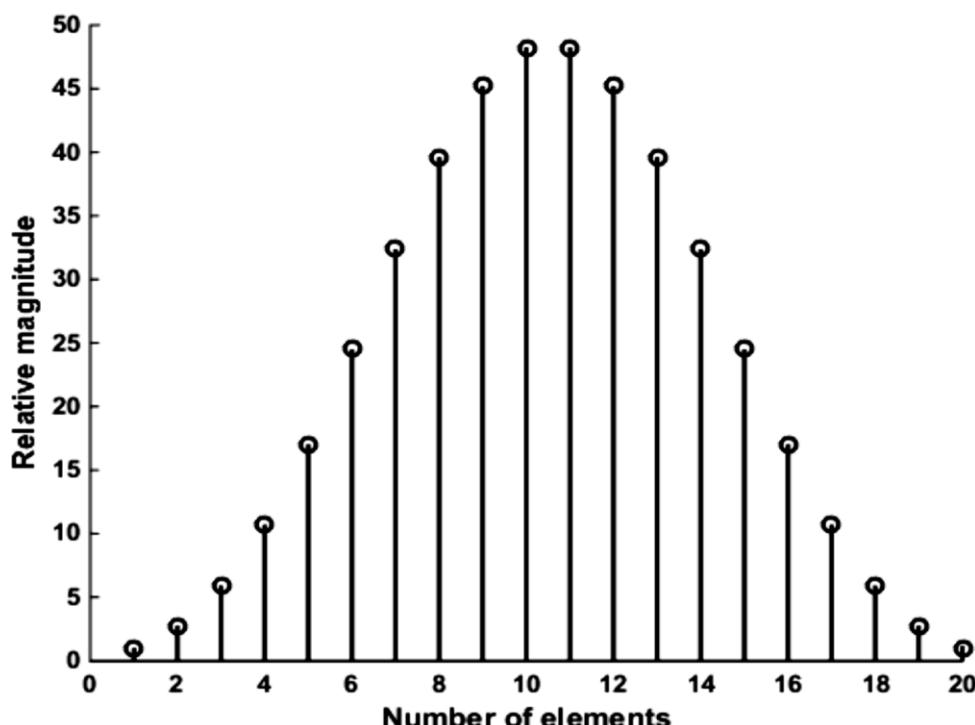


Figure 6: Amplitude distribution for the sum pattern of 20 elements for SLL= -60dB

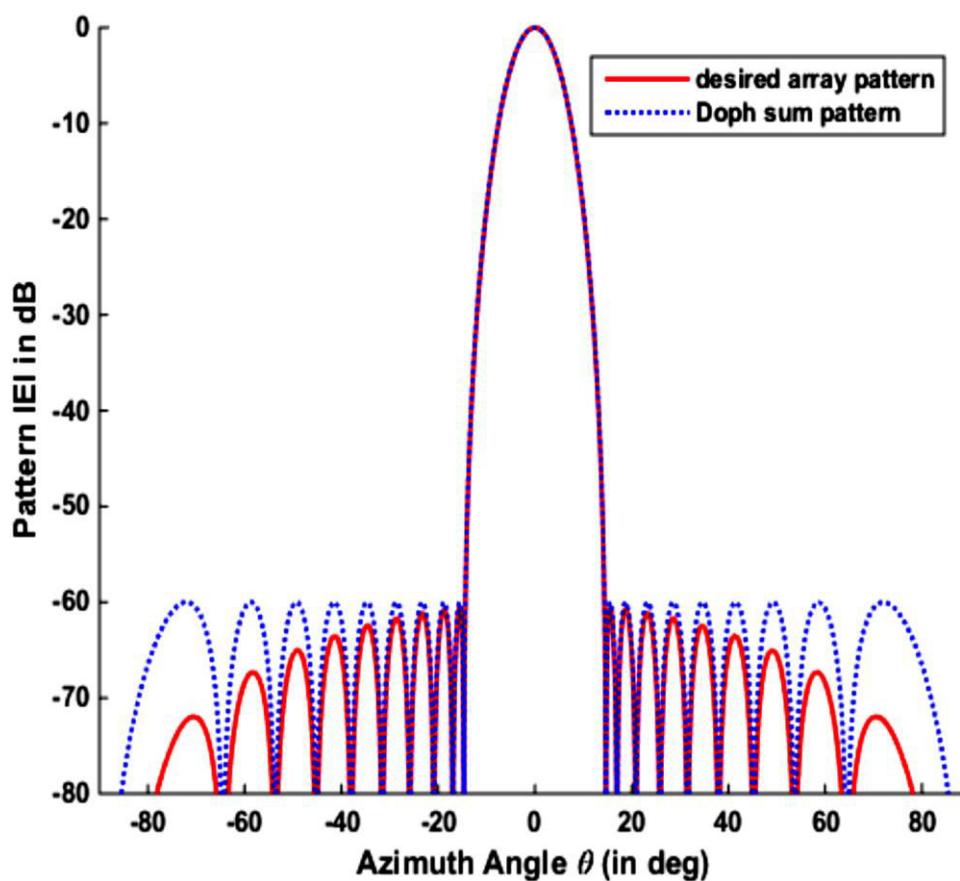


Figure 7: Radiation Patterns for 20 elements with SLL= -60dB

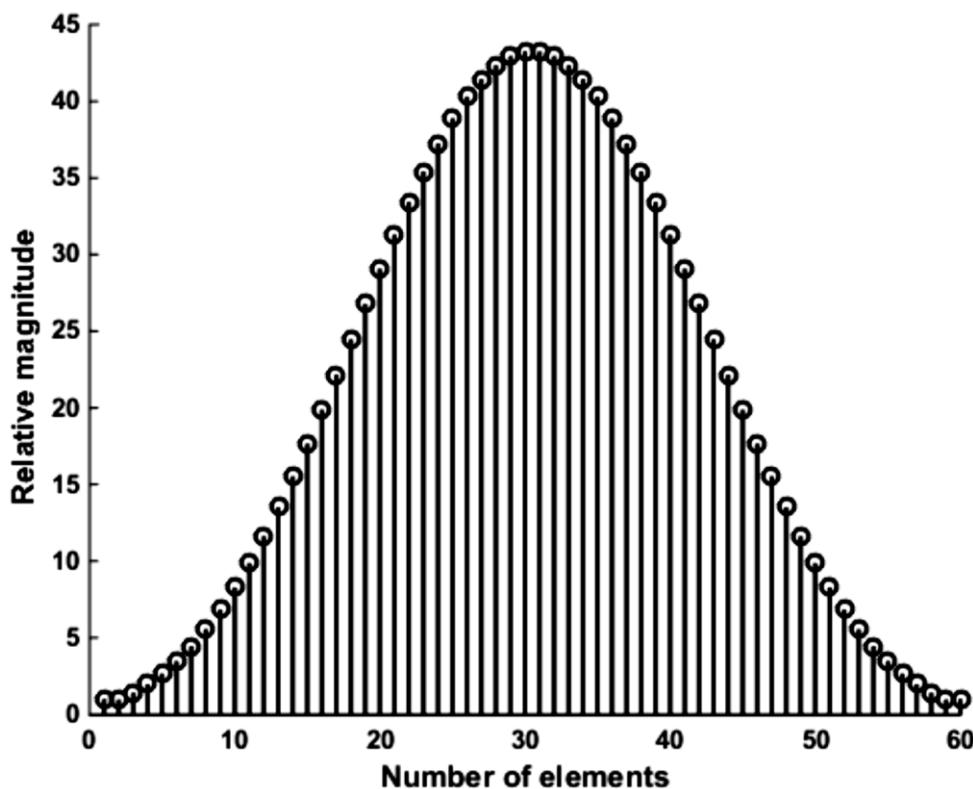


Figure 8: Amplitude distribution for the sum pattern of 60 elements for SLL= -60dB

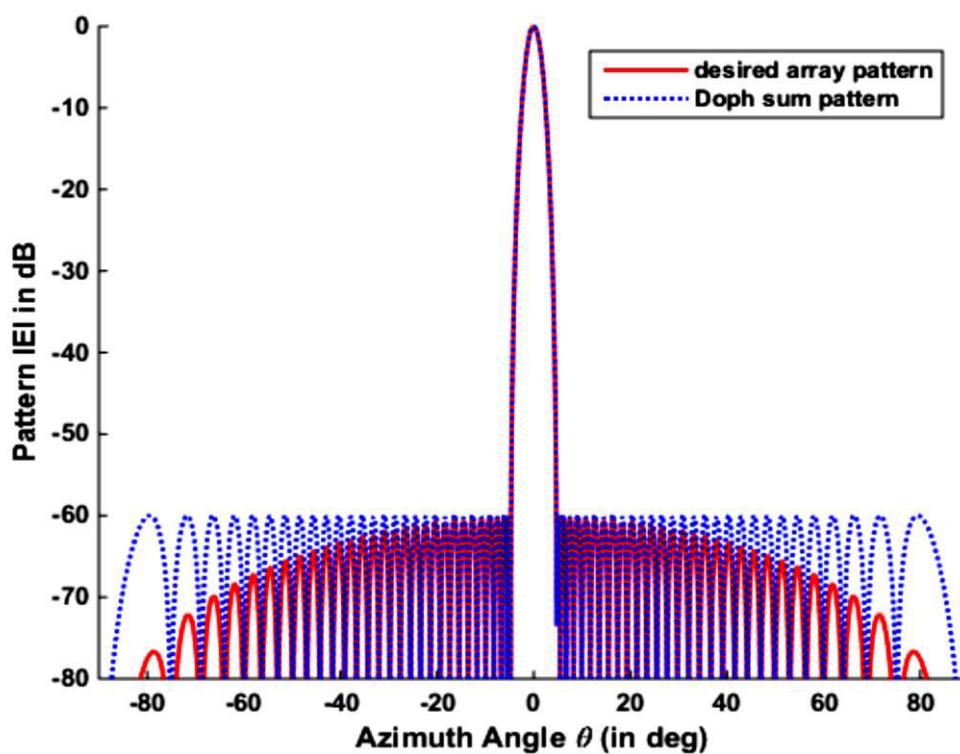


Figure 9: Radiation Patterns for 60 elements with SLL= -60dB

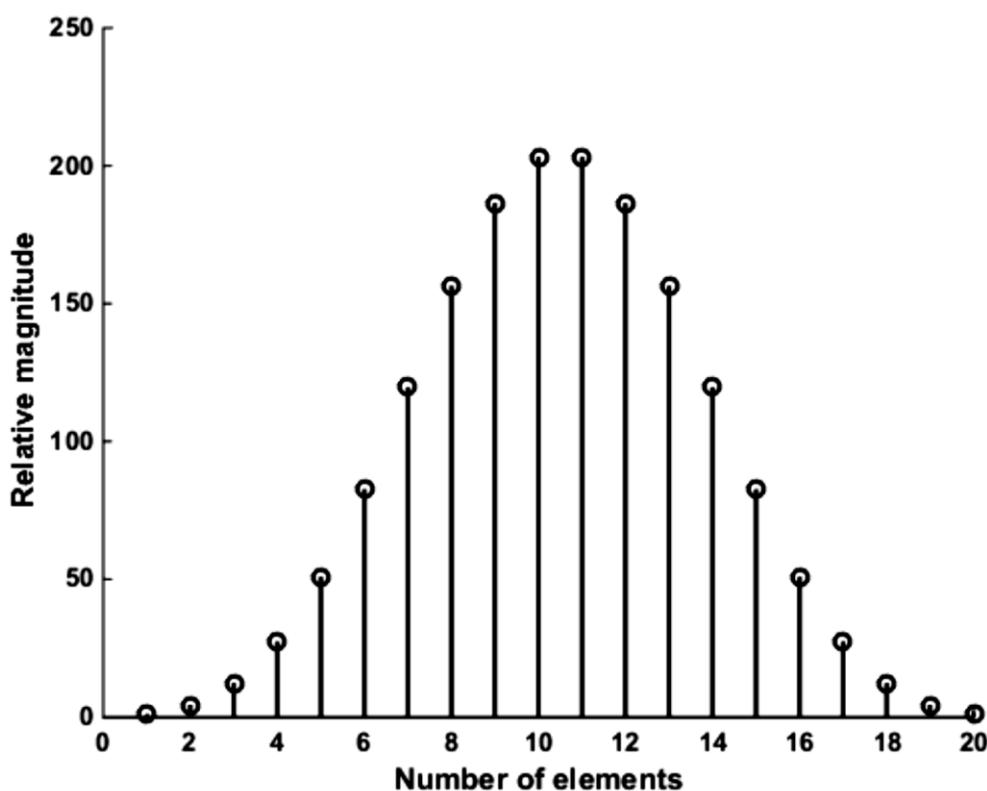


Figure 10: Amplitude distribution for the sum pattern of 20 elements for SLL= - 80dB

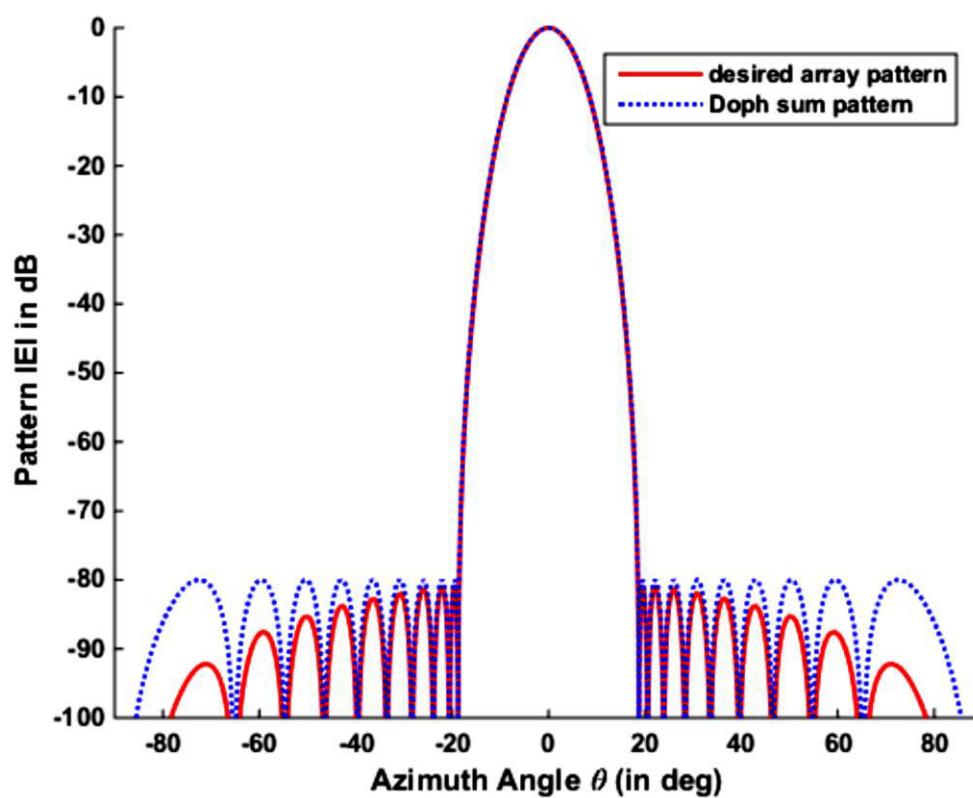


Figure 11: Radiation Patterns for 20 elements with SLL= -80dB

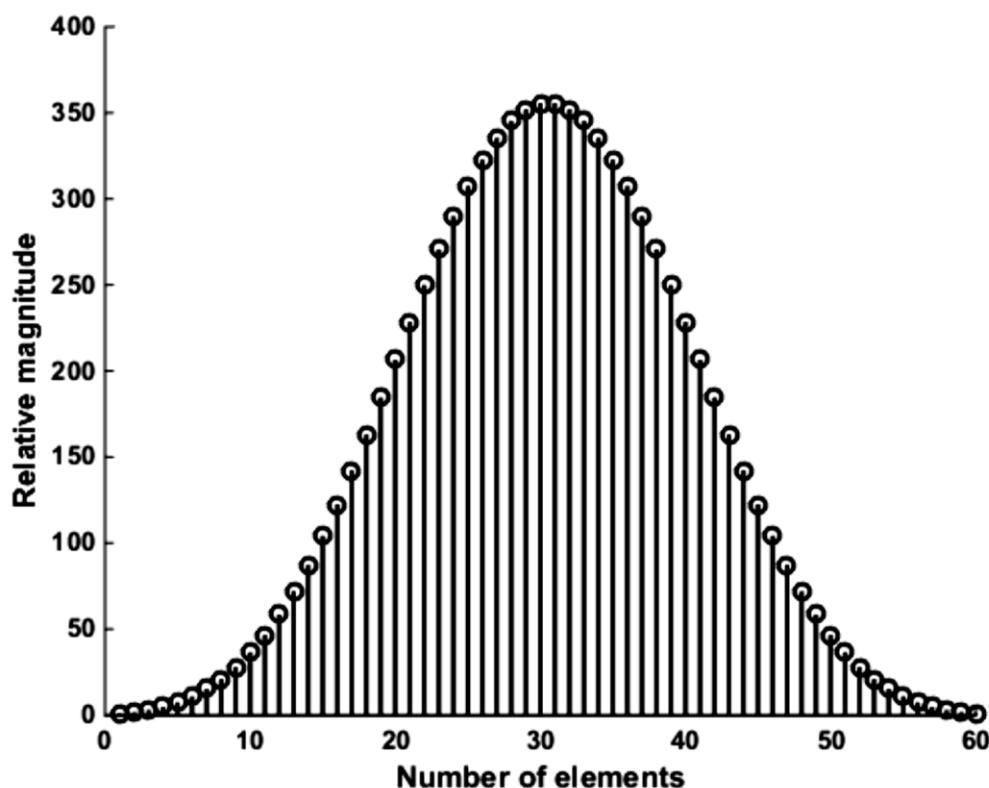


Figure 12: Amplitude distribution for the sum pattern of 60 elements for SLL= -80dB

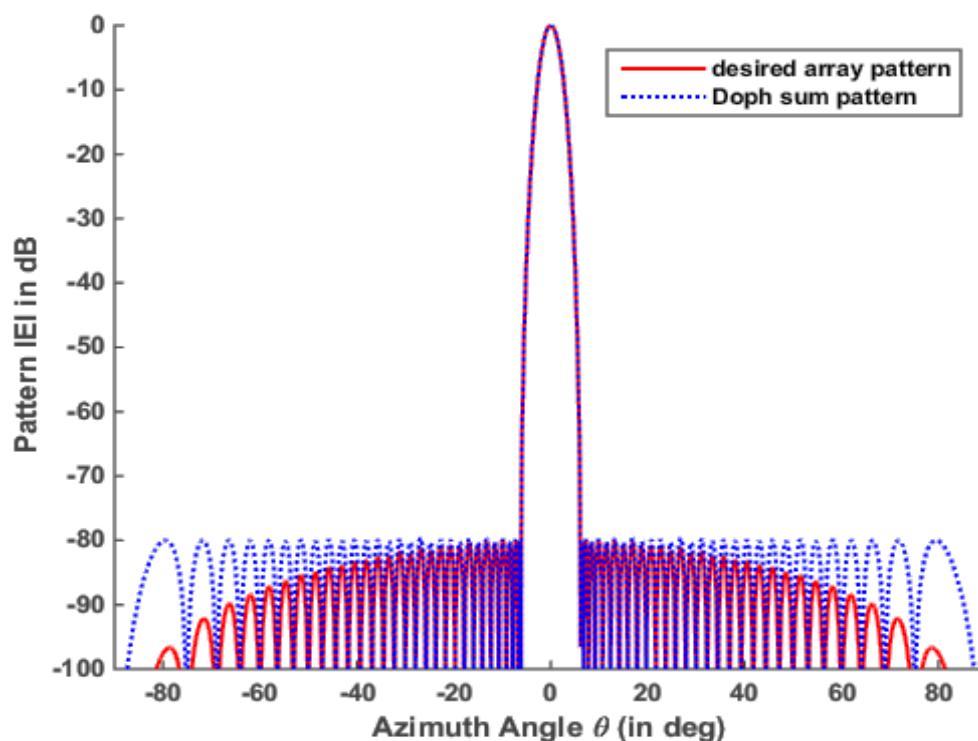


Figure 13: Radiation Patterns for 20 elements with SLL= -80dB



ISSN: 2347-1697

**International Journal of Informative & Futuristic Research (IJIFR)**

Volume - 3, Issue -11, July 2016

Continuous 35<sup>th</sup> Edition, Page No.: 4088-4100

#### 4. CONCLUSION

The study and design of a simple rectangular patch microstrip antenna and its radiation properties in E- and H- planes were described. The synthesis method is achieved and the simulation results are depicted in the present work. It is evident from the results that linear uniform array distributions resulted in a pattern with the sidelobe levels of -45dB, -60dB and -80dB. This level observed for an array of isotropic radiators and array of practical elements. However, farthest sidelobes are higher for arrays of isotropic radiators than that of the practical radiators. In view of these investigations the sum array patterns and the desired radiation patterns have to be synthesized with low sidelobe levels, higher directivities and narrow beamwidth that are used for the range detection of the target and also to determine the angular tracking accuracy. In addition to this various advantages of a microstrip patch antenna and its numerous applications in radar services were presented.

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# Moderate Fuzzy AHP Based On Multi Criteria Decision Making Methodology For Assessing E-Governance In India Using SWOT-AHP Analysis

Paper ID	IJIFR/V3/ E11/ 028	Page No.	4101-4112	Subject Area	Mathematics
KeyWords	AHP, SWOT, Ideal Fuzzy AHP, Moderate Fuzzy AHP, Change's Extent Analysis Method				

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## Abstract

Analytical Hierarchy Process is a Multi Criteria Decision Making Methods introduced by T.L.Saaty which used to solve complex decision problems. Laarhoven and Pedrycz introduced Fuzzy AHP in which triangular fuzzy numbers were used to compare fuzzy relation. Chang introduced new approach for extent analysis method on fuzzy AHP using triangular fuzzy numbers. Strength, Weakness, Opportunities and Threats (SWOT) analysis is a commonly used tool which examines and weaknesses are internal factors with opportunities and threats are external factors of e-government strategies to achieve the priorities. SWOT analysis provides the basic outline in which to perform analysis of decision situation. AHP approach achieves pairwise comparisons among factors or criteria in order to prioritize them using Eigen value calculation. The aim of applying the combined method is to obtain the ranking for the alternatives of e-government strategies in India and to analyze the priorities using Moderate AHP.



## 1. INTRODUCTION

Digital technologies serve as a basic source of transformation in economies, communities, and government functions all over the world. The occurrence of technological change of the late 1990s, the result of which was the enabling of the delivery of services over the Internet, caused major and rapid development in the transformation of governments' functioning. Development of e-commerce and the evolution projected for the near future has encouraged consumers to demand more and more customized, rapid, and at home services. The rapid development of modern information and communication technologies is having far-reaching effects on all aspects of modern life, including government.

Electronic government is necessary for developing countries like India, attempting better quality of services to their citizens. Citizens are the centre of the e-government system and play a vital role in making e-governance successful as well as with the government's policies. Gupta & Jana's (2003) suggested a flexible framework to choose an appropriate strategy to measure the tangible and intangible benefits of e-Government. Kurtila et al.(2000) examined a new hybrid method for improving the usability of SWOT. Collection of all sub factors of SWOT factor can be appropriately constructed in the following table.

**Table – 1: SWOT Analysis for Indian government**

Strengths (S)	Opportunities (O)
<p><b>S<sub>1</sub>.</b> Policy on Adoption of open source software for GOI, and e-governance resources.</p> <p><b>S<sub>2</sub>.</b> Web directory for Indian Government web sites</p> <p><b>S<sub>3</sub>.</b> E-district.</p> <p><b>S<sub>4</sub>.</b> E-governance initiatives (State and Central)</p> <p><b>S<sub>5</sub>.</b> National e-governance plan (NeGP)</p>	<p><b>O<sub>1</sub>.</b> Fast, Convenient and cost reduction.</p> <p><b>O<sub>2</sub>.</b> Transparency, Anticorruption and Accountability</p> <p><b>O<sub>3</sub>.</b> Increase the capacity of the Government and participation by people.</p> <p><b>O<sub>4</sub>.</b> Improve the quality of decision Making.</p> <p><b>O<sub>5</sub>.</b> Promote use of ICT in other sector of Society</p> <p><b>O<sub>6</sub>.</b> Quality of service delivery to Business and customers.</p>
Weaknesses (W)	Threats (T)
<p><b>W<sub>1</sub>.</b> Different languages and Population.</p> <p><b>W<sub>2</sub>.</b> Low literacy and low IT literacy.</p> <p><b>W<sub>3</sub>.</b> Lack of Integrated services and Lack of awareness in people.</p> <p><b>W<sub>4</sub>.</b> Digital divide, cost and low per Capital income.</p> <p><b>W<sub>5</sub>.</b> Service not accessible easily and Geographical problems.</p>	<p><b>T<sub>1</sub>.</b> Cyber Terrorism and cyber Crimes.</p> <p><b>T<sub>2</sub>.</b> Security and Privacy, Security breaks.</p> <p><b>T<sub>3</sub>.</b> Copy right and resistance to change.</p> <p><b>T<sub>4</sub>.</b> Computer and Internet failures.</p> <p><b>T<sub>5</sub>.</b> Mobile and SMS Technology.</p>

The above SWOT factors are determined by the following strategies for e-governance in India.

- A<sub>1</sub>. Build technical infrastructure and Institutional capacity for India.
- A<sub>2</sub>. Build legal and Judicial Infrastructure

- A<sub>3</sub>. Make all information available online and popularize e-governance.
- A<sub>4</sub>. Set standard and centre – state partnership.

## 2. SWOT-FUZZY AHP ANALYSIS:

Using Chang's (1992) extent analysis, we obtain priority vectors of the SWOT factors and priority vectors of the sub factors of SWOT group. These priority vectors are obtained on the pair – wise comparison matrix among the SWOT groups and the pairwise comparison matrices for sub factors of the SWOT groups using SWOT analysis for E-Governance in India. Before constructing the pairwise comparison matrix, set the evaluation of the fuzzy scale used by the decision makers of linguistic variables shown in the following table.

Table 2: Fuzzy AHP Scale

S. No.	Definition	Triangular Fuzzy Number	It's reciprocal
1.	Equal importance	(1,1,1)	(1,1,1)
2.	Most weakly importance	(1,1,3)	(1/3,1,1)
3.	Intermediate value	(2,2,4)	(1/4,1/2,1/2)
4.	Weakly importance	(1,3,5)	(1/5,1/3,1)
5.	Intermediate value	(2,4,6)	(1/6,1/4,1/2)
6.	Moderately importance (or) essentially important	(3,5,7)	(1/7, 1/5,1/3)
7.	Intermediate value	(4,6,8)	(1/8, 1/6, 1/4)
8.	Strongly importance	(5,7,9)	(1/9, 1/7,1/5)
9.	Intermediate value	(6,8,8)	(1/8, 1/8,1/6)
10.	Extremely Importance	(7,9,9)	(1/9,1/9,1/7)

Construct the pairwise comparison matrices and obtain their priority vectors in the following way.

Table 3: Pairwise comparison matrix of the SWOT groups with respect to the goal.

Goal	S	W	O	T
S	(1,1,1)	(3,5,7)	(7,9,9)	(3,5,7)
W	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )	(1,1,1)	(5,7,9)	(1,1,3)
O	( $\frac{1}{9}, \frac{1}{9}, \frac{1}{7}$ )	( $\frac{1}{9}, \frac{1}{7}, \frac{1}{5}$ )	(1,1,1)	( $\frac{1}{5}, \frac{1}{3}, 1$ )
T	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )	( $\frac{1}{3}, 1, 1$ )	(1,3,5)	(1,1,1)

The normalized weight vectors with respect to the goal are calculated as

$$w_G = (0.4666, 0.2047, 0.1406, 0.1879)^T$$

Table 4: Pair wise comparison matrix of the sub factors with respect to strength S.

S	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	S <sub>5</sub>
S <sub>1</sub>	(1,1,1)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )	( $\frac{1}{8}, \frac{1}{8}, \frac{1}{6}$ )	( $\frac{1}{5}, \frac{1}{3}, 1$ )
S <sub>2</sub>	(2,2,4)	(1,1,1)	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )
S <sub>3</sub>	(3,5,7)	(2, 4,6)	(1,1,1)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{5}, \frac{1}{3}, 1$ )
S <sub>4</sub>	(6,8,8)	(2,4,6)	(2,2,4)	(1,1,1)	(1,1,3)
S <sub>5</sub>	(1,3,5)	(2,4,6)	(1,3,5)	( $\frac{1}{3}, 1, 1$ )	(1,1,1)

The normalized weight vectors with respect to S are calculate as

$$w_S = (0.0079, 0.0470, 0.2805, 0.3732, 0.2911)^T$$

**Table 5: Pair wise comparison matrix of the sub factors with respect to strength W.**

W	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>5</sub>
W <sub>1</sub>	(1,1,1)	(2,2,4)	(1,3,5)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )
W <sub>2</sub>	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	(1,1,1)	(1,3,5)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )
W <sub>3</sub>	( $\frac{1}{5}, \frac{1}{3}, 1$ )	( $\frac{1}{5}, \frac{1}{3}, 1$ )	(1,1,1)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{5}, \frac{1}{3}, 1$ )
W <sub>4</sub>	(2,2,4)	(2,2,4)	(2,2,4)	(1,1,1)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )
W <sub>5</sub>	(2,4,6)	(2,2,4)	(1,3,5)	(2,2,4)	(1,1,1)

The normalized weight vectors with respect to W are calculated as

$$w_W = (0.2208, 0.1544, 0.0450, 0.2502, 0.3294)^T$$

**Table 6: Pair wise comparison matrix of the sub factors with respect to strength O.**

O	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	O <sub>4</sub>	O <sub>5</sub>	O <sub>6</sub>
O <sub>1</sub>	(1,1,1)	(2,2,4)	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{3}, 1, 1$ )	( $\frac{1}{8}, \frac{1}{6}, \frac{1}{4}$ )
O <sub>2</sub>	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	(1,1,1)	( $\frac{1}{9}, \frac{1}{7}, \frac{1}{5}$ )	(1,3,5)	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )
O <sub>3</sub>	(2,4,6)	(5,7,9)	(1,1,1)	(7,9,9)	(1,3,5)	(3,2,4)
O <sub>4</sub>	(2,2,4)	( $\frac{1}{5}, \frac{1}{3}, 1$ )	( $\frac{1}{9}, \frac{1}{9}, \frac{1}{7}$ )	(1,1,1)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	( $\frac{1}{8}, \frac{1}{8}, \frac{1}{6}$ )
O <sub>5</sub>	(1,1,3)	(2,4,6)	( $\frac{1}{5}, \frac{1}{3}, 1$ )	(2,2,4)	(1,1,1)	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )
O <sub>6</sub>	(4,6,8)	(3,5,7)	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	(6,8,8)	(3,5,7)	(1,1,1)

The normalized weight vectors with respect to O are calculated as

$$w_O = (0.2813, 0.1847, 0.2872, 0.1540, 0.0971, 0.2828)^T$$

**Table 7: Pair wise comparison matrix of the sub factors with respect to strength T.**

T	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
T <sub>1</sub>	(1,1,1)	(1,3,5)	(2,4,6)	(2,2,4)	(3,5,7)
T <sub>2</sub>	( $\frac{1}{5}, \frac{1}{3}, 1$ )	(1,1,1)	(1,3,5)	( $\frac{1}{5}, \frac{1}{3}, 1$ )	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )
T <sub>3</sub>	( $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}$ )	( $\frac{1}{5}, \frac{1}{3}, 1$ )	(1,1,1)	( $\frac{1}{5}, \frac{1}{3}, 1$ )	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )
T <sub>4</sub>	( $\frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ )	(1,3,5)	(1,3,5)	(1,1,1)	(3,5,7)
T <sub>5</sub>	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )	(2,2,4)	(2,2,4)	( $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}$ )	(1,1,1)

The normalized weight vectors with respect to T are calculated as

$$w_T = (0.3181, 0.1819, 0.0179, 0.2884, 0.1935)^T$$

**Table 8: Pair wise comparison matrix of the alternatives with respect to  $S_1$**

$S_1$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(3,5,7)	(6,8,8)	(3,5,7)
$A_2$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,1,1)	(5,7,9)	(1,1,3)
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(1,1,1)	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_4$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	$(\frac{1}{3}, 1, 1)$	(1,3,5)	(1,1,1)

Their normalized weight vector is  $w_{S_1} = (0.5409, 0.2664, 0.1636, 0.0290)^T$

**Table9: Pair wise comparison matrix of the alternatives with respected to  $S_2$ .**

$S_2$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(1,3,5)	(3,5,7)	(2,4,6)
$A_2$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(1,1,1)	(5,7,9)	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_3$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(1,1,1)	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$
$A_4$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1, 3, 5)	(4,6,8)	(1,1,1)

Their normalized weight vector is  $w_{S_2} = (0.4303, 0.3294, 0.0386, 0.2016)^T$

**Table 10: Pair wise comparison matrix of the alternatives with respected to  $S_3$**

$S_3$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(3,5,7)	(5,7,9)	(4,6,8)
$A_2$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,1,1)	(2,4,6)	(2,2,4)
$A_3$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_4$	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,3,5)	(1,1,1)

Their normalized weight vector is  $w_{S_3} = (0.6959, 0.2430, 0.0265, 0.0343)^T$

**Table 11: Pair wise comparison matrix of the alternatives with respected to  $S_4$**

$S_4$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	(1,3,5)
$A_2$	(2,4,6)	(1,1,1)	(1,1,2)	(1,3,5)
$A_3$	(4,6,8)	$(\frac{1}{2}, 1, 1)$	(1,1,1)	(2,4,6)
$A_4$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)

Their normalized weight vector is  $w_{S_4} = (0.1888, 0.3613, 0.4205, 0.0292)^T$

**Table 12: Pair wise comparison matrix of the alternatives with respected to  $S_5$**

$S_5$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(1,3,5)	$(1, \frac{1}{3}, \frac{1}{5})$	$(\frac{1}{2}, \frac{1}{4}, \frac{1}{6})$
$A_2$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_3$	(5,3,1)	(2,2,4)	(1,1,1)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$
$A_4$	(6,4,2)	(1,3,5)	(3,5,7)	(1,1,1)

Their normalized weight vector is  $w_{S_5} = (0.2621, 0.2021, 0.2563, 0.2832)^T$

**Table 13: Pair wise comparison matrix of the alternatives with respected to  $W_1$**

$W_1$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(1,3,5)	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$
$A_2$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$
$A_3$	(1,3,5)	(2,2,4)	(1,1,1)	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$
$A_4$	(2,4,6)	(6,8,8)	(7,9,9)	(1,1,1)

Their normalized weight vector is  $w_{W_1} = (0.4001, 0.0534, 0.0657, 0.4806)^T$

**Table 14: Pair wise comparison matrix of the alternatives with respected to  $W_2$**

$W_2$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(2,2,4)
$A_2$	(2,4,6)	(1,1,1)	(3,5,7)	(1,3,5)
$A_3$	(1,3,5)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,1,1)	(2,2,4)
$A_4$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)

Their normalized weight vector is  $w_{W_2} = (0.1843, 0.4975, 0.3125, 0.0055)^T$

Table 15: Pair wise comparison matrix of the alternatives with respected to  $W_3$

$W_3$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(2,4,6)	(1,3,5)	(2,2,4)
$A_2$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_3$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(3,5,7)	(1,1,1)	(2,2,4)
$A_4$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,3,5)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)

Their normalized weight vector is  $w_{w_3} = (0.4451, 0.0529, 0.3323, 0.1696)^T$

Table 16: Pair wise comparison matrix of the alternatives with respected to  $w_4$

$W_4$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(2,4,6)	(6,8,8)	(7,9,9)
$A_2$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)	(2,2,4)	(2,4,6)
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$
$A_4$	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(3,5,7)	(1,1,1)

Their normalized weight vector is  $w_{w_4} = (0.5386, 0.0193, 0.3044, 0.1375)^T$

Table 17: Pair wise comparison matrix of the alternatives with respected to  $W_5$

$W_5$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(1,3,5)	(6,8,8)	(4,6,8)
$A_2$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(1,1,1)	(1,3,5)	(2,4,6)
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$
$A_4$	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(2,2,4)	(1,1,1)

Their normalized weight vector is  $w_{w_5} = (0.5619, 0.2236, 0.1365, 0.1095)^T$

**Table 18: Pair wise comparison matrix of the alternatives with respect to  $O_1$**

$O_1$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(2,2,4)
$A_2$	(3,5,7)	(1,1,1)	(2,2,4)	(1,3,5)
$A_3$	(5,7,9)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	(2,4,6)
$A_4$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)

Their normalized weight vector is  $w_{0_1} = (0.2288, 0.3963, 0.3063, 0.0686)^T$

**Table 19: Pair wise comparison matrix of the alternatives with respect to  $O_2$**

$O_2$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(2,2,4)	(1,3,5)	(2,2,4)
$A_2$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	(2,2,4)	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$
$A_3$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$
$A_4$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(6,8,8)	(3,5,7)	(1,1,1)

Their normalized weight vector is  $w_{0_2} = (0.2862, 0.0052, 0.2212, 0.4874)^T$

**Table 20: Pair wise comparison matrix of the alternatives with respect to  $O_3$**

$O_3$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(3,5,7)	(6,8,8)	(2,2,4)
$A_2$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,1,1)	(2,2,4)	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$
$A_4$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(2,4,6)	(2,2,4)	(1,1,1)

Their normalized weight vector is  $w_{0_3} = (0.6605, 0.1501, 0.0534, 0.1360)^T$

**Table 21: Pair wise comparison matrix of the alternatives with respect to  $O_4$**

$O_4$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(5,7,9)	(4,6,8)	(2,2,4)
$A_2$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(1,1,1)	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$
$A_3$	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	(6,8,8)	(1,1,1)	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_4$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(7,9,9)	(1,3,5)	(1,1,1)

Their normalized weight vector is  $w_{0_4} = (0.4975, 0.0252, 0.2247, 0.2521)^T$

Table 22: Pair wise comparison matrix of the alternatives with respected to  $O_5$

$O_5$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(3,5,7)	(6,8,8)	(4,6,8)
$A_2$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,1,1)	(2,4,6)	(1,3,5)
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$
$A_4$	$(\frac{1}{4}, \frac{1}{6}, \frac{1}{4})$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(2,2,4)	(1,1,1)

Their normalized weight vector is  $w_{O_5} = (0.4870, 0.2319, 0.1109, 0.1701)^T$

Table 23: Pair wise comparison matrix of the alternatives with respected to  $O_6$

$O_6$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{2}, 1, 1)$
$A_2$	(5,7,9)	(1,1,1)	(7,9,9)	(3,5,7)
$A_3$	(1,3,5)	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$
$A_4$	(1,1,2)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(2,2,4)	(1,1,1)

Their normalized weight vector is  $w_{O_6} = (0.1461, 0.4978, 0.1735, 0.1826)^T$

Table 24: Pair wise comparison matrix of the alternatives with respected to  $T_1$

$T_1$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_2$	(2,2,4)	(1,1,1)	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$
$A_3$	(7,9,9)	(4,6,8)	(1,1,1)	(5,7,9)
$A_4$	(1,3,5)	(3,5,7)	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(1,1,1)

Their normalized weight vector is  $w_{T_1} = (0.1547, 0.1732, 0.4544, 0.2175)^T$

Table 25: Pair wise comparison matrix of the alternatives with respected to  $T_2$

$T_2$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(1,3,5)	(6,8,8)	(1,3,5)
$A_2$	$(\frac{1}{5}, \frac{1}{3}, 1)$	(1,1,1)	(5,7,9)	(2,4,6)
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(1,1,1)	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$
$A_4$	$(\frac{1}{5}, \frac{1}{3}, 1)$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(7,9,9)	(1,1,1)

Their normalized weight vector is  $w_{T_2} = (0.3869, 0.3361, 0.0121, 0.2647)^T$

**Table 26: Pair wise comparison matrix of the alternatives with respected to  $T_3$**

$T_3$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(2,2,4)	(6,8,8)	(5,7,9)
$A_2$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	(3,5,7)	(4,6,8)
$A_3$	$(\frac{1}{8}, \frac{1}{8}, \frac{1}{6})$	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,1,1)	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$
$A_4$	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	(2,4,6)	(1,1,1)

Their normalized weight vector is  $w_{T_3} = (0.4757, 0.3262, 0.0303, 0.1677)^T$

**Table 26: Pair wise comparison matrix of the alternatives with respected to  $T_4$**

$T_4$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	(2,2,4)	$(\frac{1}{5}, \frac{1}{3}, 1)$	(7,9,9)
$A_2$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(1,1,1)	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	(4,6,8)
$A_3$	(1,3,5)	(2,2,4)	(1,1,1)	(2,4,6)
$A_4$	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$	$(\frac{1}{8}, \frac{1}{6}, \frac{1}{4})$	$(\frac{1}{6}, \frac{1}{4}, \frac{1}{2})$	(1,1,1)

Their normalized weight vector is  $w_{T_4} = (0.4045, 0.2383, 0.3484, 0.0086)^T$

**Table 27: Pair wise comparison matrix of the alternatives with respected to  $T_5$**

$T_5$	$A_1$	$A_2$	$A_3$	$A_4$
$A_1$	(1,1,1)	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{7})$	$(\frac{1}{4}, \frac{1}{2}, \frac{1}{2})$	$(\frac{1}{2}, 1, 1)$
$A_2$	(7,9,9)	(1,1,1)	(5,7,9)	(3,5,7)
$A_3$	(2,2,4)	$(\frac{1}{9}, \frac{1}{7}, \frac{1}{5})$	(1,1,1)	$(\frac{1}{5}, \frac{1}{3}, 1)$
$A_4$	(1,1,2)	$(\frac{1}{7}, \frac{1}{5}, \frac{1}{3})$	(1,3,5)	(1,1,1)

Their normalized weight vector is  $w_{T_5} = (0.1211, 0.4193, 0.3223, 0.1372)^T$

Inabilities to assign similar values as in conventional AHP, some short modifications have been done in the number of triangular fuzzy numbers of pairwise comparison matrices. We can obtain the following Original Fuzzy AHP, Ideal Fuzzy AHP and Moderate Fuzzy AHP matrices.

**Table 28: Original Fuzzy AHP Matrix**

Criteria /Alternative	S	W	O	T	P.V.	Ranking
	0.4484	0.1967	0.1740	0.1808		
$A_1$	0.3292	0.4521	0.3362	0.2684	0.3435	1
$A_2$	0.2513	0.1680	0.1658	0.2721	0.2237	3
$A_3$	0.2176	0.1970	0.2540	0.3104	0.2366	2
$A_4$	0.2020	0.1829	0.2439	0.1491	0.1960	4

**Table 29: Ideal Fuzzy AHP Matrix**

Criteria /Alternative	S	W	O	T	P.V.	Normali zation	Ranking
	0.4484	0.1967	0.1740	0.1808			
$A_1$	1.0000	1.0000	1.0000	0.8647	0.9754	0.3367	1
$A_2$	0.7634	0.3716	0.4930	0.8766	0.6597	0.2277	3
$A_3$	0.6610	0.4357	0.7552	1.0000	0.6943	0.2397	2
$A_4$	0.6136	0.4046	0.7252	0.4803	0.5677	0.1960	4

**Table 30: Moderate Fuzzy AHP Matrix**

Criteria /Alternative	S	W	O	T	P.V.	Normali zation	Ranking
	0.4484	0.1967	0.1740	0.1808			
$A_1$	0.3292	0.4521	0.3363	0.2684	0.6463	0.2924	1
$A_2$	0.2513	0.1680	0.1658	0.2721	0.5464	0.2381	3
$A_3$	0.2176	0.1970	0.2540	0.3104	0.5393	0.2440	2
$A_4$	0.2020	0.1829	0.2439	0.1491	0.4986	0.2255	4

From the tables above, the rankings for the alternatives  $A_1$ ,  $A_2$ ,  $A_3$  and  $A_4$  in Original Fuzzy AHP, Ideal Fuzzy AHP and Moderate Fuzzy AHP models respectively as 1, 3, 2 and 4. Therefore rankings for alternatives in Original Fuzzy AHP, Ideal Fuzzy AHP and Moderate Fuzzy AHP models are the same.

### 3. CONCLUSION

Using SWOT-AHP techniques, the subfactors of SWOT factors could be prioritized and thus we could determine which subfactors of SWOT must be first given attention. This analysis has the ability of determining both the priorities of SWOT factors and the e-Government strategies. This analysis also presents us the possibility of making sensitivity analysis. The result suggests that the government of India should take step to implement strategies in the order  $A_1$ ,  $A_3$ ,  $A_2$  and  $A_4$ . People and policies play the primary role in making e-Government a success. The framework explained in this thesis provides a

direction about for consideration of the evaluation of e-Government strategies. The case study of India provides an illustrative reference for the strategy evaluation. This model would be beneficial for evaluating any other national e-Government strategies and also comparing its priority with the other e-Government strategies. The selection of various SWOT factors depends on the system profile, the type of services being offered, and the profile of the citizen being served. The qualitative analysis of these factors and strategies is highly subjective.

The analysis based on SWOT – AHP techniques can be applied to various areas such as energy, agriculture, and machine-tool industry.

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# Academic Cheating Among Senior Secondary Students In Relation To Their Peer-Pressure

Paper ID	IJIFR/V3/ E11/ 030	Page No.	4113-4122	Subject Area	Education
KeyWords	Academic Cheating, High & Low Peer-pressure, Rural & Urban, 600 Senior Secondary Students, Random Sampling				

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## Abstract

The present study was undertaken to study the academic cheating among senior secondary students in relation to their peer-pressure. Academic cheating was treated as dependent variable whereas peer-pressure was treated as independent variable. Descriptive survey method was used for the present study. Random sampling technique was used to select the sample. The sample comprised of 600 senior secondary students of private schools affiliated to Central Board of School Education (CBSE). Academic cheating scale by Kalia and Kirandeep (2011) and peer-pressure scale by Singh and Saini (2010) were used to study the academic cheating among senior secondary students in relation to their peer-pressure. Mean, Standard deviation and 't' test were used to analyse the data. The finding of the study revealed that the academic cheating of senior secondary school students with high and low peer pressure differ significantly. It was also found that significant difference exist in the academic cheating of male, female, rural and urban senior secondary school students with high and low peer pressure.

## 1. INTRODUCTION

Cheating can be considered as one of the most important issues in schools, because it is a major obstacle to infer the competence of the students. Sometimes any student who is not



eligible for academic courses can pass the course by cheating and improper ways. Cheating in school is regarded as a violation of prescribed rules or standard conditions for completing school assignments and tests (Kalia, 2005). Cheating means copying from other students' during exams, one of the forms of misconduct that has become one of the biggest concerns of educational institutions (Wilkinson, 2009). Sierra and Hyman (2008) defined academic cheating as an effort used by individuals to use data or resources on exams illegally for example, copying another student's answer or written work (plagiarized) to get some academic credit although they acknowledge those behaviour are wrong. There are four areas of academic cheating or dishonesty: a). cheating by using unauthorized materials on any academic activity such as assignment or a test, b). fabrication of information, references or results c). plagiarism and d). helping other students engage in academic dishonesty (Pavela, 1978).

Some reasons identified for the rise of academic cheating include pressure from teachers, parents, school and peers; unhealthy environment both at home and school; peer influence etc. Students are more likely to use academic dishonesty practices when they think their assignments are meaningless and they are less likely to cheat when they admire and respect their teachers and are excited about what they are learning (Cole and Kiss, 2000). Adolescents are influenced by what their peers do and they form their peer groups around similar interests. Peer influence is at its highest at this point in their lives. If peers in their peer group are choosing academic dishonesty, then they are more likely to do the same (McCabe, 1999). Generally "peer pressure" is a term used to describe how one's behavior is influenced by other fellows. It refers to the influence exerted by a peer group in encouraging a person to change his or her attitudes, values, or behavior in order to conform to group norms.

## 2. VARIABLES USED

**Independent Variable:** Peer Pressure

**Dependent Variable:** Academic Cheating

## 3. OBJECTIVES OF THE STUDY

- I. To study the academic cheating of senior secondary school students with high peer pressure and low peer pressure.
- II. To study the academic cheating of male senior secondary school students with high peer pressure and low peer pressure.
- III. To study the academic cheating of female senior secondary school students with high peer pressure and low peer pressure.
- IV. To study the academic cheating of rural senior secondary school students with high peer pressure and low peer pressure.
- V. To study the academic cheating of urban senior secondary school students with high peer pressure and low peer pressure.

#### 4. HYPOTHESES OF THE STUDY

- I. There is no significant difference in academic cheating of senior secondary school students with high peer pressure and low peer pressure.
- II. There is no significant difference in academic cheating of male senior secondary school students with high peer pressure and low peer pressure.
- III. There is no significant difference in academic cheating of female senior secondary school students with high peer pressure and low peer pressure.
- IV. There is no significant difference in academic cheating of rural senior secondary school students with high peer pressure and low peer pressure.
- V. There is no significant difference in academic cheating of urban senior secondary school students with high peer pressure and low peer pressure.

#### 5. RESEARCH METHODOLOGY

In the present study descriptive survey method was employed.

##### I. SAMPLE

600 senior secondary school students affiliated to C.B.S.E. selected on the basis of random sampling method.

##### II. TOOLS USED

a. **Academic Cheating Scale (2011)** by Kalia and Kirandeep was used to measure academic cheating among students. The odd items versus even items were correlated using Spearman Brown Split Half method and also Guttman's Split Half method. The Spearman Brown coefficient was .87 and Guttman Split Half Coefficient was .86 and the Cronbachs' alpha was .91 suggesting the high reliability of the scale. On the basis of face validity and content validity, it appears reasonable to agree that Academic Cheating scale measures academic cheating among adolescents.

b. **Peer Pressure Scale (2010)** by Singh and Saini was selected to measure the level of peer pressure among students. This scale have high test-retest reliability ( $r= 0.33^{**}$ ,  $p<.01$ ) and Internal consistency ( $=0.77^{**}$ ). The experts opined that the scale has good face validity and content validity.

##### III. STATISTICAL TECHNIQUES

Mean, Standard deviation and 't' test were used to analyse the data.

#### 6. RESULTS OF THE STUDY

##### 6.1 To study the academic cheating of senior secondary school students with high peer pressure and low peer pressure.

For the purpose of studying the difference between academic cheating of senior secondary school students with high peer pressure and low peer pressure, the following null hypothesis was formulated:

*There is no significant difference in academic cheating of senior secondary school students with high peer pressure and low peer pressure.*

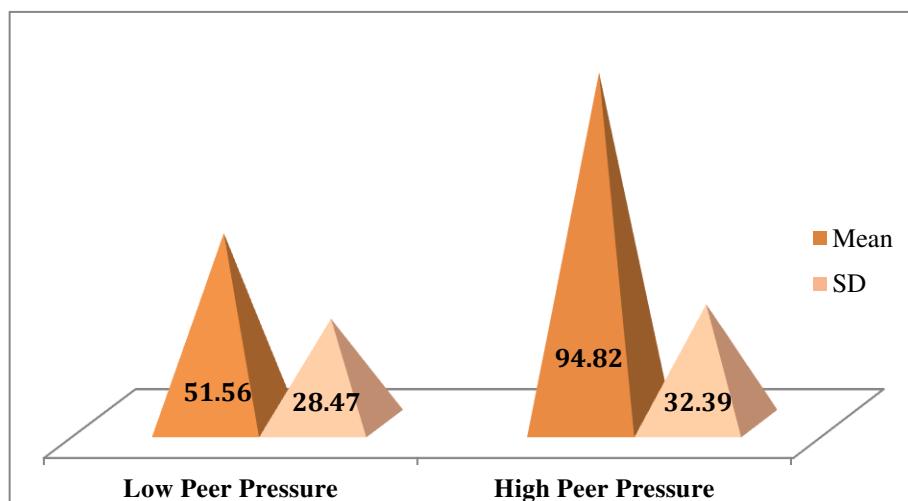
To test the null hypothesis, Mean, Standard Deviation, Standard Error of Mean, t-value, degrees of freedom (df), and level of significance of the scores of senior secondary school students obtained from academic cheating scale was calculated with respect to peer pressure. The results are presented in Table 1:

**Table 1: Descriptive statistics related to the Academic Cheating of Senior Secondary School Students with High Peer Pressure and Low Peer Pressure**

Group (Peer Pressure)	N	Mean	SD	't' value	Level of Significance
Low Peer Pressure	192	51.56	28.47	13.4**	Significant
High Peer Pressure	171	94.82	32.39		

\*\*Significant at .01 level \* Significant at .05 level

NS-Not significant



**Figure 1: Peer Pressure wise Mean academic cheating scores and SDs of Senior Secondary School Students**

From the Table 1 and Fig.1, it can be observed that the t-value of 13.4 was found significant at 0.01 levels with 361 degrees of freedom, which indicates that the academic cheating of senior secondary school students with low and high peer pressure differ significantly. So, the null hypothesis i.e. there exists no significant difference in the academic cheating of senior secondary school students with low and high peer pressure, is **rejected**. Thus, we can say that academic cheating is affected by peer pressure. In terms of Mean, it can be seen that mean academic cheating score of senior secondary school students with low peer pressure i.e. **51.56** has been found lesser than that of senior secondary school students with high peer pressure i.e. **94.82**. The present result is in consonance with the result of Anderman & Murdock (2007) who also stated that peer influence plays a major role among adolescents in choosing academic dishonesty over academic integrity.

#### **6.2 To study the academic cheating of male senior secondary school students with high peer pressure and low peer pressure.**

For the purpose of studying the difference between academic cheating of male senior secondary school students with high peer pressure and low peer pressure, the following null hypothesis was formulated:

*There is no significant difference in academic cheating of male senior secondary school students with high peer pressure and low peer pressure.*

To test the null hypothesis, Mean, Standard Deviation, Standard Error of Mean, t-value, degrees of freedom (df), and level of significance of the scores of male senior secondary school students obtained from academic cheating scale was calculated with respect to peer pressure. The results are presented in Table 2:

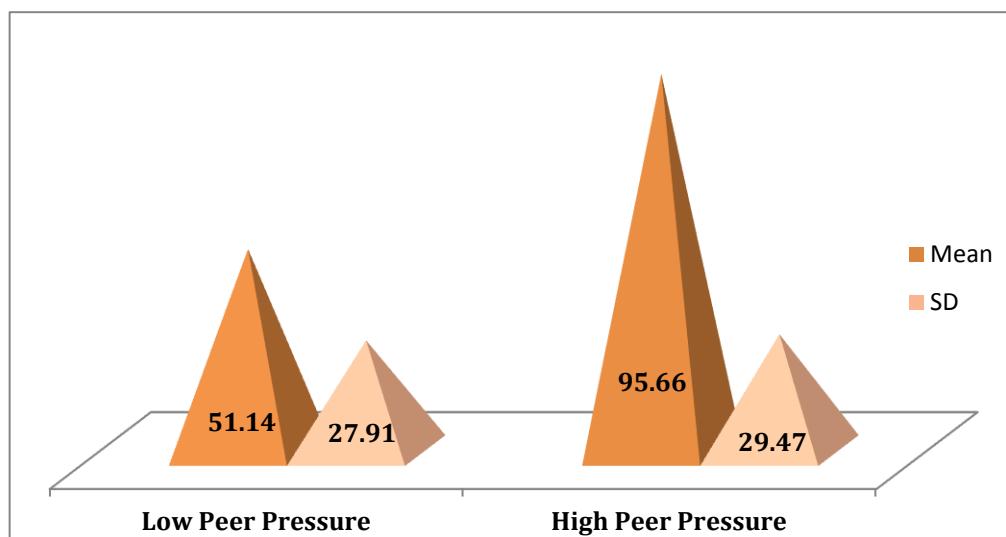
**Table 2:Descriptive statistics related to the Academic Cheating of Male Senior Secondary School Students with High Peer Pressure and Low Peer Pressure**

Group (Peer Pressure)	N	Mean	SD	't' value	Level of Significance
Low Peer Pressure	98	51.14	27.91	10.35**	
High Peer Pressure	82	95.66	29.47		Significant

\*\* Significant at .01 level

\* Significant at .05 level

NS-Not significant



**Figure 2: Peer Pressure wise Mean academic cheating scores and SDs of Male Senior Secondary School Students**

From the Table 2 and Fig.2, it can be observed that the t-value of 10.35 was found significant at 0.01 levels with 178 degrees of freedom, which indicates that the academic cheating of male senior secondary school students with low and high peer pressure differ significantly. So, the null hypothesis i.e. there exists no significant difference in the academic cheating of male senior secondary school students with low and high peer pressure, is **rejected**. Thus, we can say that academic cheating is affected by peer pressure. In terms of Mean, it can be seen that mean academic cheating score of male senior secondary school students with low peer pressure i.e. **51.14** has been found lesser than that of male senior secondary school students with high peer pressure i.e. **95.66**. The reason may be that high peer-pressure among male children can lead them to a loss of

individuality and living in bad company can force to get under the pressure or influence of bad habits like academic cheating.

### 6.3 To study the academic cheating of female senior secondary school students with high peer pressure and low peer pressure.

For the purpose of studying the difference between academic cheating of female senior secondary school students with high peer pressure and low peer pressure, the following null hypothesis was formulated:

*There is no significant difference in academic cheating of female senior secondary school students with high peer pressure and low peer pressure.*

To test the null hypothesis, Mean, Standard Deviation, Standard Error of Mean, t-value, degrees of freedom (df), and level of significance of the scores of female senior secondary school students obtained from academic cheating scale was calculated with respect to peer pressure. The results are presented in Table 3:

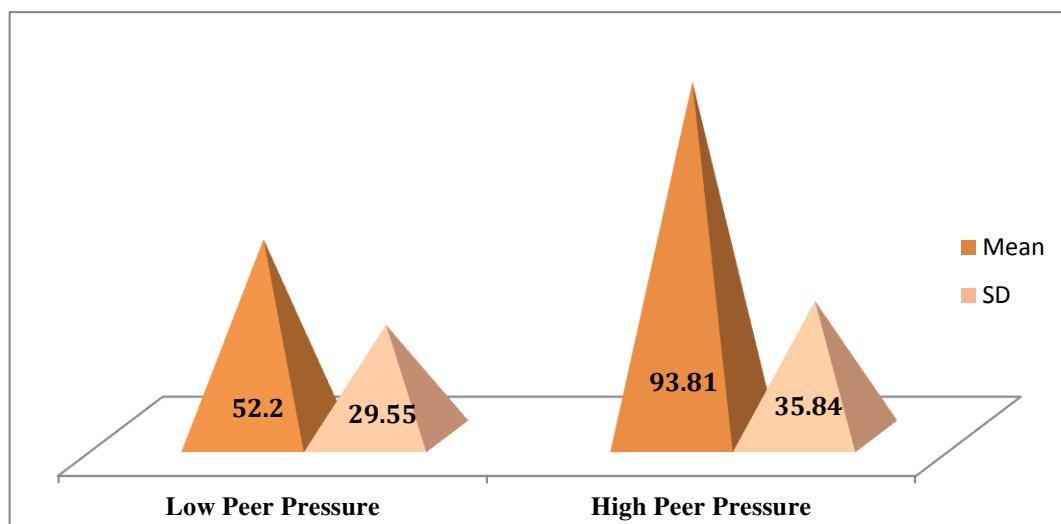
**Table 3: Descriptive statistics related to the Academic Cheating of Female Senior Secondary Students with High Peer Pressure and Low Peer Pressure**

Group (Peer Pressure)	N	Mean	SD	't' value	Level of Significance
Low Peer Pressure	94	52.2	29.55	8.56**	
High Peer Pressure	89	93.81	35.84		Significant

\*\* Significant at .01 level

\* Significant at .05 level

NS-Not significant



**Figure 3: Peer Pressure wise Mean academic cheating scores and SDs of Female Senior Secondary School Students**

From the Table 3 and 3, it can be observed that the t-value of 8.56 was found significant at 0.01 levels with 181 degrees of freedom, which indicates that the academic cheating of female senior secondary school students with low and high peer pressure differ significantly. So, the null hypothesis i.e. there exists no significant difference in the academic cheating of female senior secondary school students with low and high peer pressure, is **rejected**. Thus, we can say that academic cheating is affected by peer pressure. In terms of Mean, it can be seen that mean academic cheating score of female

senior secondary school students with low peer pressure i.e. 52.2 has been found lesser than that of female senior secondary school students with high peer pressure i.e. 93.81. It is generally seen that female have more tendency to compare themselves with siblings or other peers. Due to this reason female students can feel high pressure to get better and this high peer pressure she may get involved in academic cheating.

#### **6.4 To study the academic cheating of rural senior secondary school students with high peer pressure and low peer pressure.**

For the purpose of studying the difference between academic cheating of rural senior secondary school students with high peer pressure and low peer pressure, the following null hypothesis was formulated:

*There is no significant difference in academic cheating of rural senior secondary school students with high peer pressure and low peer pressure.*

To test the null hypothesis, Mean, Standard Deviation, Standard Error of Mean, t-value, degrees of freedom (df), and level of significance of the scores of rural senior secondary school students obtained from academic cheating scale was calculated with respect to peer pressure. The results are presented in Table 4.

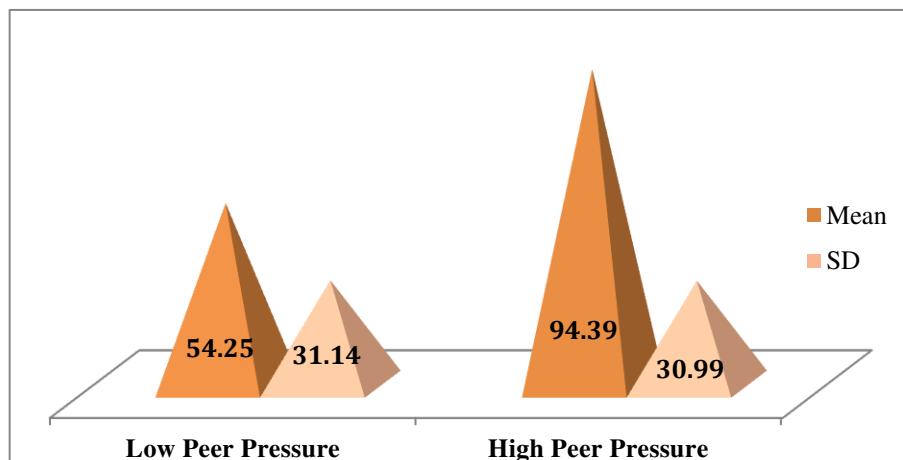
**Table 4: Descriptive statistics related to the Academic Cheating of Rural Senior Secondary Students with High Peer Pressure and Low Peer Pressure**

Group (Peer Pressure)	N	Mean	SD	't' value	Level of Significance
Low Peer Pressure	102	54.25	31.14	8.92**	
High Peer Pressure	88	94.39	30.99		Significant

\*\* Significant at .01 level

\* Significant at .05 level

NS-Not significant



**Figure 4: Peer Pressure wise Mean academic cheating scores and SDs of Rural Senior Secondary School Students**

From the Table 4 and Fig.4, it can be observed that the t-value of 8.92 was found significant at 0.01 levels with 188 degrees of freedom, which indicates that the academic cheating of rural senior secondary school students with low and high peer pressure differ significantly. So, the null hypothesis i.e. there exists no significant difference in the academic cheating of rural senior secondary school students with low and high peer pressure, is **rejected**. Thus, we can say that

academic cheating is affected by peer pressure. In terms of Mean, it can be seen that mean academic cheating score of rural senior secondary school students with low peer pressure i.e. **54.25** has been found lesser than that of rural senior secondary school students with high peer pressure i.e. **94.39**. Generally it is seen that rural child possess lower level of self-control and can enforce the strategies agreed upon among their peers as they do not want to be left out of the group.

#### **6.5 To study the academic cheating of urban senior secondary school students with high peer pressure and low peer pressure.**

For the purpose of studying the difference between academic cheating of urban senior secondary school students with high peer pressure and low peer pressure, the following null hypothesis was formulated:

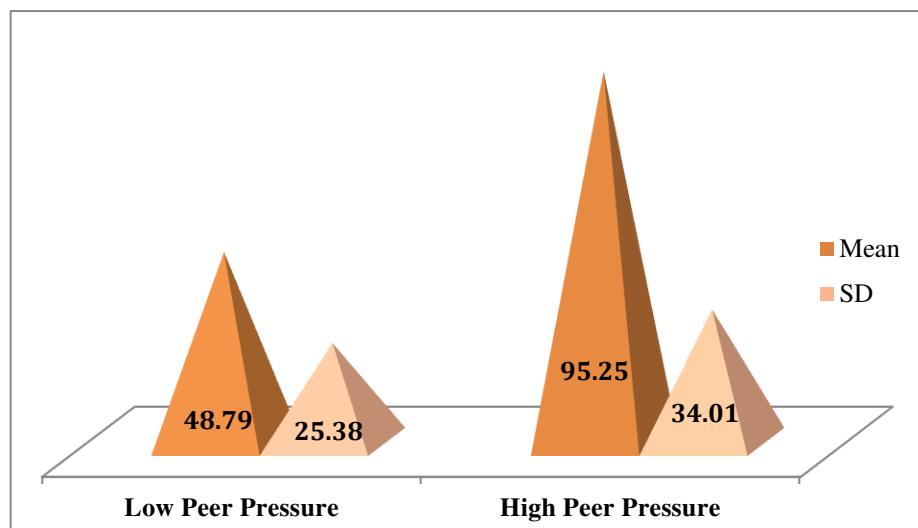
*There is no significant difference in academic cheating of urban senior secondary school students with high peer pressure and low peer pressure.*

To test the null hypothesis, Mean, Standard Deviation, Standard Error of Mean, t-value, degrees of freedom (df), and level of significance of the scores of urban senior secondary school students obtained from academic cheating scale was calculated with respect to peer pressure. The results are presented in Table 5:

**Table 5: Descriptive statistics related to the Academic Cheating of Urban Senior Secondary Students with High Peer Pressure and Low Peer Pressure**

Group (Peer Pressure)	N	Mean	SD	't' value	Level of Significance
Low Peer Pressure	90	48.79	25.38	10.32**	Significant
High Peer Pressure	83	95.25	34.01		

\*\* Significant at .01 level   \* Significant at .05 level   NS-Not significant



**Figure 5: Peer Pressure wise Mean academic cheating scores and SDs of Urban Senior Secondary School Students**

From the Table 5 and Fig.5, it can be observed that the t-value of 10.32 was found significant at 0.01 levels with 171 degrees of freedom, which indicates that the academic

cheating of urban senior secondary school students with low and high peer pressure differ significantly. So, the null hypothesis i.e. there exists no significant difference in the academic cheating of urban senior secondary school students with low and high peer pressure, is **rejected**. Thus, we can say that academic cheating is affected by peer pressure. In terms of Mean, it can be seen that mean academic cheating score of urban senior secondary school students with low peer pressure i.e. **48.79** has been found lesser than that of urban senior secondary school students with high peer pressure i.e. **95.25**. This can be due to the reason that parents in the urban areas put more pressure on their child to score more marks in the examination than their peer group; and under this high peer pressure the child commits the biggest mistakes of their lives by adopting the way of cheating to score high.

## 7. FINDINGS OF THE STUDY

- A significant difference was found in the academic cheating of senior secondary school students with high and low peer pressure.
- It was found that the academic cheating of male senior secondary school students with high and low peer pressure differ significantly.
- A significant difference was found in the academic cheating of female senior secondary school students with high and low peer pressure.
- It was also found that the academic cheating of rural senior secondary school students with high and low peer pressure differ significantly.
- A significant difference was found in the academic cheating of urban senior secondary school students with high and low peer pressure differ significantly.

## 8. CONCLUSION

Cheating is a burning issue in educational field mounting hindrances in the path of efficacy of educational system. Sarita and Dhaiya (2015) in their article academic cheating among students defined that parents and teachers may also increase pressure on their kids when they compare them to their siblings. Pressure can cause students to want to achieve to their highest capability. Yet, when the pressure builds up and it gets to be too much, they may break. Cracking under pressure and feeling overwhelmed may also contribute to why students choose to cheat (Kleiner & Lord, 1999; Riera& Di Prisco, 2002). So it is the duty of both parents and teachers to reduce the the pressure on child for better performance. Teachers must also provide alternatives to the students to facilitate their learning so that they do not search for alternatives.

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